

## Article

# The Role of Local Government in the Bottom-Up Energy Transformation of Poland on the Example of the Lower Silesian Voivodeship

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**Abstract:** This article focuses on the role of local government in energy transition. The aim of this article is to answer the question of whether local government authorities undertake actions aimed at the energy transformation of the region. This article is based on both literature studies and independent research. The empirical research was carried out in the Lower Silesian Voivodeship, located in Southwestern Poland. This region was chosen because it experienced the negative effects of economic transformation (liquidation of the Lower Silesian Coal Basin). Two hypotheses (H1 and H2) were adopted in the article. H1 assumes that in Polish conditions, bottom-up energy transformation requires the involvement of local authorities, and they should act as both initiators and shareholders of energy cooperatives. According to H2, local authorities participate in the energy transition to a limited extent. According to the conducted surveys, there has been no investment in wind farms, hydroelectric power plants or biogas plants. Communes are not interested in large, capital-intensive investments, limiting themselves to local actions with a small spatial range and small economic significance, although they are aware of the advantages of RES.



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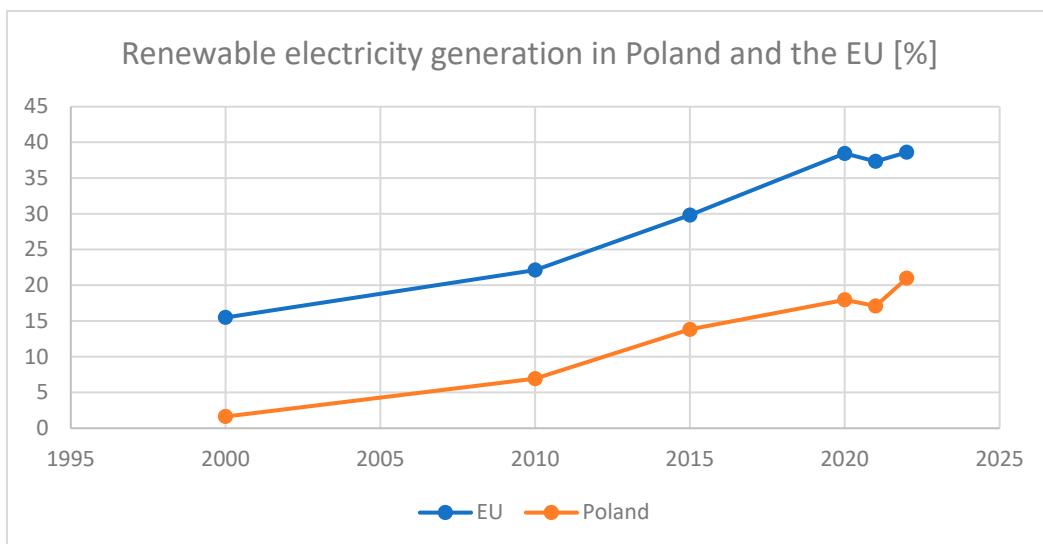
## 1. Introduction

Changes in energy policy, especially since the Renewable Energy Directive 2018/2001/EU entered into force in December 2018 [1], have focused on the development of renewable energy sources. In addition, the Regulation of the European Parliament on the reduction of greenhouse gas emissions by all EU countries of 15 March 2023 forces the reduction of greenhouse gas emissions by 40% by 2030 compared to 2005 levels [2]. Therefore, all Member States must reduce greenhouse gas emissions and further develop renewable energy sources.

In 2022, 91% of the world's total anthropogenic CO<sub>2</sub> emissions came from fossil fuels [3], and burning coal alone generated about 40% of CO<sub>2</sub> emissions [3]. In 1990, around 95% of CO<sub>2</sub> emissions came from burning fossil fuels in the EU [4]. The electricity generation and industrial sectors are responsible for the highest emissions as they consume the most energy, as well as fuels with the highest sulfur content [5]. At the same time, nearly half of the EU electricity is generated in CHP plants based on fossil fuels (mostly coal, oil and gas) [5]. This area of the energy sector also requires rapid changes and a fast transition to renewable sources. For this reason, the Fit for 55 climate package was implemented in the EU. It assumes the reduction of greenhouse gas emissions in Europe by as much as 55% by 2030 (compared to the level from 1990), and the achievement of climate neutrality by 2050.

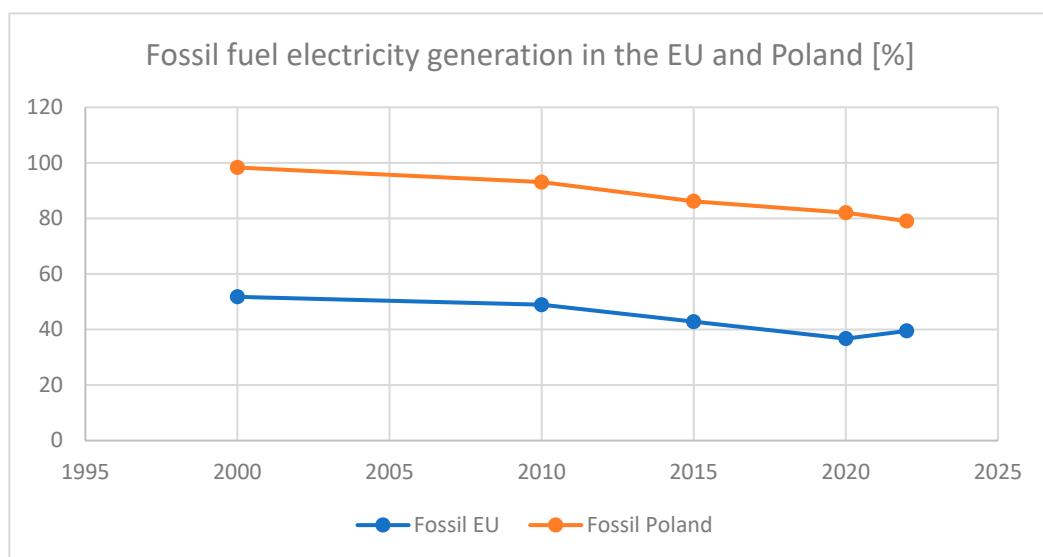
In Poland, this problem is particularly important as coal-fired power generation causes excessive pollution and affects both the environment and human health, especially the respiratory and circulatory systems. According to the HEAL report, it causes about 50,000 premature deaths annually in this country. Across the EU, that is 400,000 deaths a year [6]. That is why it is so important to develop renewable sources.

Changes have been taking place for many years, but they are very slow. The share of renewable energy sources in electricity production in the years 2000–2022 increased in the EU from 15.2% to 38.6% and in Poland from 1.63% to 20.98% (Figure 1).



**Figure 1.** Source: Own elaboration based on the European Electricity Review, Ember, 2023, <https://ember-climate.org/insights/research/european-electricity-review-2023/> [accessed on 27 May 2023].

On the other hand, the share of fossil fuel electricity generation in the years 2000–2022 fell in the EU from 51.79% to 39.48% and in Poland from 98.37% to 79.02% (Figure 2).



**Figure 2.** Source: Own elaboration based on the European Electricity Review, Ember, 2023 <https://ember-climate.org/insights/research/european-electricity-review-2023/> [accessed on 27 March 2023].

Meanwhile, the planned energy transformation scenario assumes an 86% share of energy generation from RES by 2050 [7]. Poland will have to adapt to the guidelines of the EU energy policy. It should be emphasized that favorable changes are taking place in Poland in this respect. In particular, PV and heat pumps are developing; unfortunately, wind energy is developing more slowly [8]. However, it is necessary to accelerate these activities and focus on the area of energy generation, transmission and distribution. In the government document “Energy Policy until 2040” [9], the need to accelerate the development of RES (especially those ensuring stable energy supplies) is emphasized, as well as the modernization of grid infrastructure and the construction of new energy storage facilities. It will be necessary to simultaneously finance the modernization of transmission networks, regulate civic energy communities and develop conditions for the development of distributed energy.

Currently, many modernization projects are planned to be implemented, aiming at increasing the possibility of connecting new power from renewable sources by over 230% by 2030, when the share of RES in Poland’s electricity production is expected to reach 50% [9].

The driving force behind energy transformation in Poland is home photovoltaics. The total capacity of household installations increased from 8.5 GW in February 2022 to 12.3 GW in February 2023 [9]. However, further changes will require reconstruction of the energy production and distribution market, which will not be possible without the involvement of local authorities and residents. This is confirmed by the experience of countries such as Germany, Sweden and Austria. In these countries, commitments to reduce CO<sub>2</sub> emissions made by the EU directly influenced a number of projects on the development of renewable energy sources, such as wind and solar farms. They are mainly implemented by renewable energy communities that have been developing in many countries for many years. They are particularly popular in Germany [10,11], Denmark [12], Austria [13], Sweden [14] and in Switzerland (EnergieSchweiz, 2019 [15]). They function in various legal forms, such as energy cooperatives, foundations and associations.

So far, only six energy cooperatives have been established in Poland. In order to expect their development, the local government should be involved in their organization and financing. The role of local governments in creating energy communities can be crucial. First of all, they have extensive powers to support energy communities already at the investment preparation stage. They deal with the development of a concept for the growth of local energy based on RES in the area of a commune, association of communes or a powiat, together with the necessary analysis for the needs of these studies. They also have the opportunity to support activities related to the creation of an energy community by preparing analyses and studies related to the establishment and registration of energy cooperatives and other forms of a collective presumption that can be used on the basis of current legal conditions. This also applies to the development of business and management documents for energy communities, e.g., strategy, business plan, operational management plan and documentation necessary to obtain funds from various sources, both public and private, such as analyses necessary to develop an application for funding, feasibility studies, business plans and due diligence studies. Second, local governments also have an important role to play in the field of education and promotion of RES. They should take actions aimed at the general public (e.g., education of local communities in the field of rational and responsible use of energy, promotion of RES, informing about the benefits of joining a renewable energy community).

An energy community is a form of cooperation of at least two participants to jointly generate and use energy [16]. Such communities constitute a legal and organizational framework for the development of local energy sources [17]. Energy Communities (CE) in EU law are defined differently in two directives. The first definition of “Citizen Energy Community” (CEC) is contained in the revised Internal Market Directive 2019/944 (also known as the IMD Directive) [18]. The second one is contained in the RED II Directive and defines Energy Communities as “renewable energy communities” (REC) [1]. The main

difference between the two types of energy communities is the type of energy used and the proximity of the participants. While CECs are limited to electricity, RECs are open to different types of energy (electricity, heating), as long as the energy is obtained from renewable sources. The geographical proximity of the participants is a binding condition for the creation of the REC, which is not necessary for the functioning of the CEC.

CE is a policy tool to increase citizen participation in various energy projects. They are supposed to ensure the possibility of obtaining low-cost energy of a certain type, e.g., renewable energy, for members or shareholders, rather than to ensure profit, as in the case of a traditional power plant. CE is also defined as a form of organization created to meet some of its energy needs [19]. These are organizations that bring together a group of local residents and bring benefits to the local community [20]. Such an organization supplies electricity to users who are its members. Many authors refer to the idea of decentralized [21], collective decision-making and collective organization of RES projects [22,23]. However, most definitions seem to agree that non-commercial organizations are generally involved in CE projects. Therefore, the term “renewable energy community” refers to energy cooperatives, municipal utility companies and trust funds for the development of renewable energy sources. Chaudhry et al. propose a new model of organization of the renewable energy community, in addition to the above-mentioned [24]. These are Renewable Energy Consumer Stock Ownership Plans (RE-CSOPs). This would make it possible to share energy in housing estates consisting of several multi-unit buildings, which would also allow the members of the cooperative to achieve benefits.

RED II clearly states that CE members must be individuals, SMEs or local authorities, including municipalities (Article 2(16b)). For this reason, the literature expresses views that local support is needed for the development of renewable energy projects and, thus, emphasizes the importance of local actors for energy communities [25]. Municipalities are such entities. They can act as cooperation partners, shareholders in the community, network actors, investors or purchasers of the energy produced.

The role of local authorities in the energy transformation, including the development of energy cooperatives, is particularly important in Poland. One reason for this, among others, is the existence of a command-and-control economy for over 40 years, which not only did not allow for the development of local entrepreneurship, but also had a negative impact on the level of social capital, resulting in the reluctance of the inhabitants to cooperate and undertake bottom-up initiatives. As a result, in Poland, local authorities should be the initiators of bottom-up changes in the energy sector to a greater extent than in countries with many years of democratic and market traditions.

The purpose of this article is to answer the question of whether local government authorities (municipalities) undertake actions aimed at the energy transformation of the region.

## 2. Local Government in Poland

The political and economic transformation (initiated at the end of 1989) meant that in 1990, the local government was reactivated in Polish conditions. The self-government at the local (municipal) level was recreated as the first. The legal basis for its operation was regulated by the Act of 8 March 1990 on commune self-government [26].

This Act stipulates, among other things, the tasks of the municipality. It should be emphasized that the legislator defined them very broadly. The tasks of a commune include all public tasks of a local nature, excluding those reserved for other entities by a separate act. When arranging the catalog of tasks of local government, they can be divided into four categories of matters:

- Technical infrastructure—e.g., roads, public transport, network infrastructure;
- Social policy—e.g., care for children under three, upbringing (kindergartens), education (primary schools), health care, social care;
- Local development—e.g., tax policy (local taxes and charges), business environment infrastructure, spatial planning;

- Environmental protection—e.g., development of renewable energy sources, thermal modernization, green areas.

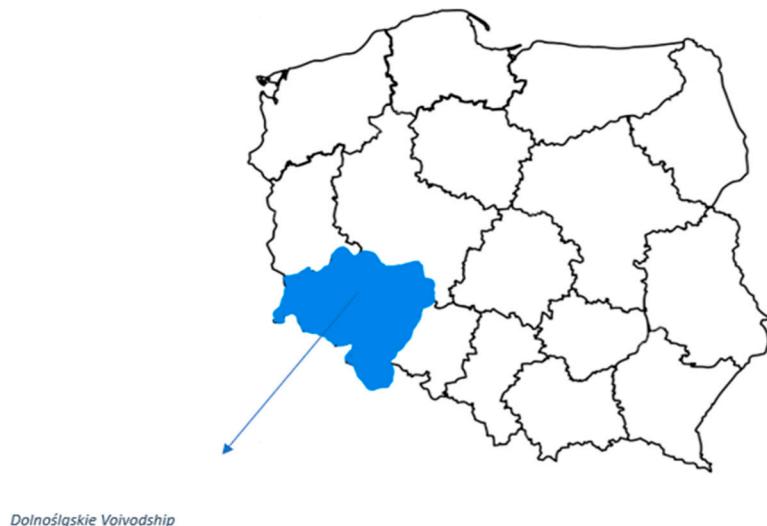
In addition to its own tasks, the commune performs tasks commissioned by the government administration under the Act. These tasks are obligatory for the commune. On the other hand, commissioned tasks transferred to the commune through agreements with government administration bodies are optional tasks for the commune [27].

As seen from the above considerations, the tasks of the commune include, among others, shaping and conducting local development policy. However, it should be noted that this development should be subordinated to the principles of sustainable development. Civilization advancement and economic growth cannot take place at the expense of the natural environment. That is why it is so important for municipalities to support the development of renewable energy sources in their area. At the same time, RES will help municipalities achieve greater energy independence, which is important from the point of view of both residents and entrepreneurs.

### 3. Methodology

This article is based on both literature studies and survey research. A critical analysis of the literature on the subject was made, and the results of research conducted in selected European Union countries were presented. Outside Poland, the focus was on countries where bottom-up energy transformation has a long tradition and where different solutions can be adopted in Poland.

The empirical research was carried out in the Lower Silesian Voivodeship located in Southwestern Poland (Figure 3).



**Figure 3.** Map of Poland: Lower Silesian Voivodeship. Source: <https://www.gov.pl/web/dvbt2/dvb-t2hevc-dolnoslaskie-w-pierwszej-kolejnosci> [accessed on 28 April 2023].

After 1989, this region underwent a deep economic restructuring, which led to a number of negative socioeconomic effects (including unemployment) that are still visible today. The restructuring caused the liquidation of one of the two coal basins operating in Lower Silesia, i.e., the Lower Silesian Coal Basin (hard coal). At the same time, disputes between Poland and the Czech Republic threatened the functioning of the Turoszów Brown Coal Basin (brown coal). The Lower Silesian Coal Basin was located near Wałbrzych and Nowa Ruda and covered an area of approx. 530 km<sup>2</sup>. Four mines operated in its area, i.e., the Julia Hard Coal Mine, the Victoria Hard Coal Mine, the Wałbrzych Hard Coal Mine, and the Nowa Ruda Hard Coal Mine. As a result of the systemic transformation initiated in 1989, the Lower Silesian Coal Basin was liquidated. The last mine was officially closed in 1999.

The Turoszów Brown Coal Basin is located in the southwestern part of Lower Silesia, and its area (within Poland) is approx. 150 km<sup>2</sup>. The negative experiences of economic transformation mean that there is strong resistance to change in Lower Silesia. On the other hand, failure to act may lead to another crisis, which will not only affect the condition of the local economy but may also threaten the energy security of municipalities and their inhabitants. That is why the energy transformation of Lower Silesia is so important. However, local authorities must participate in activities for energy transformation, which should initiate and support (including financial) activities aimed at the development of RES.

Eighteen communes located in the Lower Silesian Voivodship were randomly selected for the survey. The questionnaires were sent to commune secretaries. In Poland, these are people who manage the administration of the commune, and therefore, they are the people who have the best knowledge about the functioning and directions of development of the commune. The advantage of this approach is direct access to information sources. However, this method also has the disadvantage that the representatives of the communes often do not see the barriers to the development of RES in the communes themselves (e.g., spatial planning). Therefore, the results of the survey were compared with earlier research conducted in energy cooperatives.

Municipalities selected for this study are divided into urban communes (the territory of the commune covers the area of the city) and urban–rural and rural communes (the territory of the commune covers the area of the city and rural areas or rural areas, respectively). This division was intentional (Table 1). It resulted from the fact that both legal solutions (e.g., the 10 h rule for wind farms—the distance of the windmill from the buildings cannot be less than 10 times the height of the windmill), as well as spatial, environmental and economic conditions, hinder or even prevent the development of selected forms of RES in cities.

**Table 1.** List of communes participating in the survey.

The Name of the Commune	Type of Municipality	Population	Surface km <sup>2</sup>
Głogów	urban	60,158	35.1
Karpacz	urban	4500	38.0
Szczawno-Zdrój	urban	5467	14.7
Góra	urban–rural	18,617	266.1
Pieszyce	urban–rural	9500	63.6
Prochowice	urban–rural	7500	102.5
Prusice	urban–rural	9300	158.0
Radków	urban–rural	8500	140.0
Sobótka	urban–rural	5697	136.3
Strzelin	urban–rural	21,545	171.4
Szczytna	urban–rural	6933	132.4
Wleń	urban–rural	4045	86.1
Złoty Sok	urban–rural	4353	75.3
Lubań	rural	6288	142.3
Nowa Ruda	rural	11,000	139.7
Przeworno	rural	4568	112.0
Stoszowice	rural	5121	110.7
Zgorzelec	rural	9000	15.9
Razem		202,092	1940.1
Dolny Śląsk		2,901,225	19,947.0

Source: Surveys and data from the Central Statistical Office, 2021.

Finally, the research covered 3 urban communes and 15 urban–rural and rural communes out of a total of 169 communes located in Lower Silesia (35 urban communes and 134 urban–rural and rural communes).

The total area of the communes covered by this study was 1940.1 km<sup>2</sup> (approx. 10% of the area of the Lower Silesian Voivodeship), inhabited by approx. 202,000 inhabitants (approx. 7% of the total population of the Lower Silesian Voivodeship).

The research was conducted using a questionnaire containing 17 questions, both closed and open. The survey was conducted using the Forms program. The questions were divided into three parts. Questions 1–3 concerned the general characteristics of the commune, i.e., the name of the commune, type of commune (urban, rural, urban–rural) and population. Questions 4–11 referred to the commune's energy situation.

Respondents pointed to:

- Used energy sources (traditional, renewable);
- Renewable energy sources (solar, wind, water, biogas plants);
- Advantages of RES;
- Barriers to the development of RES in the commune;
- Investments planned by the commune in the development of renewable energy sources.

Questions 12–17 concerned the development potential of energy cooperatives in the communes. Representatives of municipalities were asked about the following:

- Development plans for energy cooperatives;
- Forms of RES (solar panels, wind power plants, water power plants, biogas plants);
- Potential sources of investment financing;
- Potential beneficiaries of the energy cooperative.

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

**H1.** *In Polish conditions, bottom-up energy transformation requires the involvement of local authorities. Local authorities should act as both initiators and shareholders of energy cooperatives.*

**H2.** *Local authorities will participate in the energy transition, but will not be interested in participating in energy cooperatives. They will choose the cheapest solutions that will allow them to reduce the costs of electricity used in public buildings.*

#### 4. Results

The research shows that traditional sources of electricity currently dominate in the area of communes. This fits in with the general condition of the energy sector in Lower Silesia (Poland) and in all country and proves the need for energy transformation. In the case of six communes, electricity came only from traditional sources (these are: Głogów, Nowa Ruda, Prochowice, Przeworno, Radków and Strzelin). In other cases, communes used renewable energy sources, but the share of these sources in the total electricity production was low and did not exceed 5%. The exception was the Prusice commune, where approx. 70% of the energy came from renewable sources. The reasons for this situation can be found in various activities of the authorities of the Prusice commune for the development of RES. For example, the commune is the majority shareholder of Prusice PS Energetyka Odnawialna Sp. z o.o., which is a leader in projects related to obtaining EU funds for the development of renewable energy sources.

Unfortunately, among the RES sources, the representatives of the communes indicated only photovoltaics. So far, none of the surveyed communes has invested in wind farms, hydro power plants or biogas plants. This leads to the conclusion that communes are not interested in large, capital-intensive investments, limiting themselves only to local actions with a small spatial range and low economic importance. Unfortunately, it should be emphasized that as a result of the undertaken investments, the electricity generated is used only to meet the needs of municipal units. These investments do not generate new jobs and are not able to meet the growing demand for electricity reported by business entities and residents of communes. As a result, the actions taken so far by the municipalities do not lead to a real energy transformation.

Important information is provided by the analysis of the reasons for such low involvement of local governments in the development of RES. High costs of building RES installations were indicated as the main reason. This barrier was indicated by 12 communes. Other barriers include the reluctance of the inhabitants (three communes), unfavorable

terrain (two communes), legal restrictions (two communes) and environmental restrictions (2 communes).

At the same time, communes are aware of the advantages associated with the development of RES. The most important advantage was the reduction of energy costs. It was indicated by 18 communes. It should be emphasized that the importance of this factor will grow. Despite the fact that, in accordance with the act freezing energy prices in 2023, local governments will not pay market prices for electricity, the maximum rate of EUR 170/MWh was still higher than the previous year's rate of 56 EUR/MWh. In addition, the upper limit of the energy price applies only this year and is expected to increase in the coming years.

The respondents also emphasized the importance of RES for ensuring the energy security of the commune (13 communes). Local governments also see the possibilities of using energy from RES to improve the safety of the inhabitants of the commune, e.g., through the development of street lighting. However, only one commune sees the possibility of creating additional jobs in the development of RES.

Analyzing the advantages of RES perceived by municipalities, it can be concluded that in the future, municipalities will continue to develop mainly photovoltaics. Only three surveyed communes intend to go beyond investments related to photovoltaics. The Prusice commune also intends to develop wind energy and biogas plants. The communes of Stoszowice and Strzelin are also planning to build a biogas plant.

The limited activities of the commune for the development of RES are also a barrier to the development of energy cooperatives. According to the survey, there are no energy cooperatives operating in the communes in question. These results are confirmed by the data included in the central register of energy cooperatives kept by the National Center for Agricultural Support.

At the same time, research shows that seven communes are planning to participate in an energy cooperative. The communes of Prusice, Złoty Stok, Stoszowice, Strzelin, Pieszyce, Wleń and Szczawno-Zdrój declared their willingness to participate in the energy cooperative.

Relatively little interest in energy cooperatives on the part of municipalities results from the barriers they perceive. The following barriers have been identified as the most important:

- Lack of funds for investments;
- High costs of building the installation;
- The reluctance of the inhabitants;
- Lack of interest on the part of potential members of cooperatives, including agricultural sector entities;
- Imprecise provisions regarding the rules of cooperation with the Distribution System Operator (DSO) and the seller;
- Lack of DSO connection networks for areas where RES installations of higher capacity can be located;
- The requirement to ensure that 70% of the cooperative members' needs are covered in the installed capacity.

According to the presented research, relatively little interest in the activities of communes for the development of energy cooperatives results from both financial reasons (high costs of investments related to the development of more powerful energy, budgetary problems of communes) and legal solutions that are unfavorable in the opinion of communes. In addition, the problem is the reluctance of the inhabitants of communes and the low interest of private entities in participating in energy cooperatives.

An interesting reason for the lack of interest in the commune's participation in the energy cooperative is their involvement in the energy cluster. The choice of a cluster as a form of cooperation may result from the fact that, unlike cooperatives, its functioning is not regulated in Polish law. Therefore, it is not burdened with obligations, for example, related to the need to cover 70% of the demand of cooperative members with energy from RES. On

the other hand, the cluster is generally worse in terms of available financial preferences. It does not benefit from the same preferences as cooperatives in terms of distribution fees [28].

The planned development of energy cooperatives is to take place primarily on the basis of photovoltaics. Nevertheless, the three previously mentioned communes, i.e., Prusice, Stoszowice and Strzelin, are planning to build a biogas plant.

The investments are to be financed from their resources and EU funds. In two cases, the capital is to come from a bank loan. According to the conducted research, the energy produced by energy cooperatives would be used primarily to power public utility buildings.

## 5. Discussion

The literature on the subject emphasizes the key role of municipalities in the bottom-up energy transformation and the development of energy cooperatives. Meister et al. show in their research that municipal support complements national support policies, especially if municipalities are members of cooperatives [29]. Their research focused on energy cooperatives operating in the field of electricity generation, as this is the most developed activity in the renewable energy sector in Germany and Switzerland [29]. Studies on the development of renewable energy communities based on PV in Germany and Italy, showing the dynamics of their development, were also conducted by Wierling, Zeis, Lupi, Candelise, Sciallo and Schwanitz [30].

Meister et al. show in their research that the development of CE in Germany and Switzerland has a very long tradition. The first communities were established at the turn of the 19th and 20th centuries with the development of electrification [29]. Contemporary communities in Germany and Switzerland are characterized by similar dynamics—strong growth until 2011 and a significant decline after 2013. In the case of 60% of renewable energy cooperatives in Germany and 50% in Switzerland, municipalities (just after private individuals) constituted an important group of members. At the same time, municipalities in Switzerland, more often than in Germany, supported cooperatives financially, especially if the municipality was a member.

Additionally, in Poland, municipalities should be an important factor in the bottom-up energy transformation. Especially in Poland, we are still dealing with a low level of social capital, resulting in low involvement of residents in grassroots initiatives, which is confirmed, among others, by the research conducted by Łabędzki and Struś in the border areas of Lower Silesia [31]. Other authors also emphasize that individualism and reluctance to cooperate still dominate in Poland [32]. That is why it is so important for municipalities to initiate and participate in energy cooperatives.

Unfortunately, it is difficult to conclude from the results of the conducted research that the communes are aware of their role. Eleven out of eighteen communes surveyed did not see the need to engage in the bottom-up process of energy transformation. Błażejewska and Gostomczyk also drew attention to the passivity of local authorities in their earlier research [32]. At the same time, it is worth emphasizing that the considerations conducted by these authors concern mainly rural areas and the possibility of farmers' participation in innovative energy initiatives. Iglinski et al. [33] also drew attention to the importance of RES development in rural areas. According to the authors, the development of RES is conducive to the sustainable development of these areas and ensures energy security and even energy self-sufficiency of individual regions.

Meister et al. 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 by administrative procedures [29]. Swiss cooperatives (41%) and German cooperatives (34%) indicated the support of municipalities for fast 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 the purchase of electricity at cost-covering prices.

In Poland, municipalities can also influence the development of RES through proper spatial planning and providing land for the location of wind farms, photovoltaic farms or biogas plants. Earlier research conducted by Kostecka-Jurczyk, Marak and Struś shows that the current provisions of local spatial development plans often limit the development of RES, and, thus, do not favor the creation and functioning of energy cooperatives [28]. However, studies conducted in the communes themselves do not confirm the earlier findings. Municipalities do not see any problems in spatial planning. It is also puzzling that representatives of local authorities did not pay attention to the problems related to the non-adjustment of the provisions of the Public Procurement Act with regard to the functioning of communes in energy cooperatives (the need to announce a tender for the purchase of energy produced by a cooperative of which the commune is a member). This problem was raised by representatives of energy cooperatives in an earlier study [28].

According to the conducted research, Lower Silesian communes are willing to invest primarily in photovoltaics, which results from relatively lower investment costs. It is worth emphasizing that the above situation is not unique to Poland. In Germany, as much as 80% of cooperatives are PV cooperatives, and only 5% are biogas ones [34].

The capital barrier identified by the communes is confirmed in previous studies. Soeiro and Dias drew attention to the problems related to the limitations in the scope of raising capital [35]. In turn, B. Klagge and T. Meister [29] emphasized the importance of high costs associated with the investment, with a simultaneous reluctance to engage large private entities that are profit-oriented.

The conducted research also shows that communes notice problems related to access to the energy market and cooperation with energy network operators. In the literature, these barriers were also noted by the above-mentioned Soeiro and Dias [35]. In turn, Marzec drew attention to the unfavorable legal solutions functioning on the Polish market, and in particular to the principle, according to which the total installed capacity of all renewable energy source installations operated by the cooperative must cover at least 70% of the own needs of the energy cooperative and its members during the year [36].

The problem raised by the communes related to the unsatisfactory functioning of the Distribution System Operators was also identified in the research carried out by Kostecka-Jurczyk, Marak and Struś at Spółdzielnia Energetyczna—Nasza Energia and Spółdzielnia Energetyczna EISALL [28]. These studies show that DSOs are not prepared to cooperate with energy cooperatives [28]. DSOs are not able to accept additional RES capacity, especially when weather conditions are conducive to higher production. This is due to the lack of energy storage facilities and obsolete networks, which are about 60 years old and require thorough modernization.

## 6. Conclusions

The energy transformation in Poland is slow and encounters serious barriers. In part, the reasons for this situation can be traced to the negative experiences of society related to the economic transformation carried out after 1989.

In the case of Lower Silesia, it resulted in the liquidation of the Lower Silesian Coal Basin and, as a result, a long-term recession in the region, the effects of which are still visible today. As a result, central authorities are cautious about decarbonization efforts. That is why bottom-up initiatives aimed at energy transformation are so important. However, the low level of social capital means that Poles do not engage in grassroots activities to a sufficient extent. Therefore, it is necessary to have an entity that will initiate and support such activities. Such an entity should be the local (municipal) self-government, especially since, in light of the legal solutions in force in Poland, it is responsible for local development.

Unfortunately, as research has shown, traditional energy sources still dominate in municipalities. Energy from RES is of marginal importance (usually, it does not exceed 5%). In addition, due to financial conditions, the communes have so far invested mainly in photovoltaic installations. Such point-based activities are aimed only at meeting the own needs of the commune and serving the residents and local businesses to a limited extent.

The research also shows that the communes have not been involved in the establishment and operation of energy cooperatives so far. In the future, as it results from the declarations of communes, the above situation may change positively, but not all communes are interested in the development of cooperatives.

The reasons for such an approach of municipalities can be found in numerous identified barriers, including primarily financial, legal and organizational barriers related to the functioning of energy network operators.

The research also shows that future activities of municipalities will be aimed at reducing the costs of electricity used for their own needs and those of subordinate units. What is missing, however, is a broader view of energy transformation as a factor of local development. Apart from a few exceptions, the communes do not plan activities that would generate new jobs or strengthen the potential of local enterprises by providing them with access to cheaper and cleaner energy. Bottom-up energy transformation in Poland requires the following actions to be taken by both the government and local authorities. First of all, the state authorities should liberalize the regulations on the location of wind farms (the 10 h rule, which means that the distance between the windmill and residential buildings must be at least 10 times the height of the windmill). The financing of investments in RES should also be strengthened. The state financially supports the development of individual (in single-family houses) photovoltaics. However, there is no comprehensive support financed by the Polish Development Fund or Bank of Gospodarstwa Krajowego (this is not a commercial bank, but a special state bank granting preferential loans for various investments). It is also necessary to modernize the grid, which is not adapted to the increased production of RES, and to develop energy storage facilities. Municipalities, on the other hand, should improve spatial planning and ensure the provision of land for RES investments. A good solution would be a public-private partnership in the construction of RES farms (both PV and wind farms), as well as biogas and hydro power plants.

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