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Investments in Renewable Energy Sources in the Concepts of Local Spatial Policy: The Case of Poland

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Abstract: The paper aims to determine the role and formula of investments in renewable energy sources in Poland's concepts of local spatial policies. It analyses 12,777 planning documents of local spatial policy (these are resolutions adopted by municipalities—in Poland there are two types of these instruments: studies of spatial development conditions and directions and local spatial development plans) in Poland enacted in 2005–2020. On this basis, local concepts were classified and related to the geographical and functional characteristics of municipalities. Poland is an interesting case study in this respect, providing a good reference point for broader international considerations. It was found that only 58.4% of Polish municipalities include renewable energy sources in their spatial policy concept. These are definitely more often urbanised municipalities. The degree of approach to renewable energy sources is also determined by the location of the municipality in the given province. The authors diagnose serious weaknesses in the Polish spatial planning system, consisting in the lack of skilful implementation of renewable energy sources into it. This is one of the reasons for the weaker development of renewable energy sources in the country. The authors consider as an innovative element of the research the analysis of the content of all spatial policy instruments in a given country, from the perspective of renewable energy sources, including proposing a way to verify these instruments.

Keywords: renewable energy sources; spatial policy; spatial policy tools; investment efficiency

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1. Introduction

The effectiveness of implementing investments in renewable energy sources is significantly related to the spatial policy tools available in the specific national order and the concept of the spatial management system. The way these tools are applied, their mutual coherence, and the skilful combination of specialist, urban planning, and legal language determine the efficient (and at the same time conceptually coordinated) implementation of investments. The latter assumptions are crucial, if only after considering the guidelines of the Territorial Agenda 2030 and the implementation of the European Reconstruction Fund [1,2]. The issue of renewable energy sources is one of the more critical issues there. Therefore, continued reflection is needed on the direction and implementation of renewable energy sources in local spatial policies.

In the present dimension, two essential research issues come together. On the one hand, it is efficiency in implementing renewable energy sources [3,4]. The second issue is the characteristics of national spatial planning systems, especially spatial policy tools, including the opportunities and limitations associated with them [5]. This paper aims to determine the role and formula of investments in renewable energy sources in Poland's concepts of local spatial policy. Concepts of approaches to renewable energy sources in

local spatial policies were distinguished, and a typology of these approaches was made. On this basis, reference is made to a broader international discussion.

The most frequently mentioned renewable energy sources are: solar energy, wind energy (dominating in Poland), water energy, biomass energy and geothermal energy [6]. It must be stressed that there is a severe need to expand investment in this field in Poland. The European Commission expects that Poland, as a member of the European Union, should achieve the share of renewable energy sources in the mix of generated power up to 32% by 2030 [7,8]. This is quite a challenge, bearing in mind that Poland is currently trying to achieve a 15% share. Poland has the lowest rate in Central Europe in this respect [9–11]. In addition to wind energy, opportunities can be seen in solar energy and biomass and biogas energy.

Poland is a critical case study for several reasons. Against the background of the European Union countries, it requires a severe and intensive development of renewable energy sources. Therefore, the discussion on the current solutions touches on crucial issues from the perspective of practice [12]. Besides, the literature describing the system of spatial planning, describes numerous weaknesses generating seriously advanced spatial chaos. It is worth noting that the costs of spatial chaos have been analysed and documented in great detail in Poland [13,14]. The link between spatial chaos and spatial policy errors has also been demonstrated [15–17]. A broad reflection on the directions of its repair is required. This reflection can be an essential point of reference for other countries. Many of the problems occurring in the Polish system are also present (in varying degrees of intensity) in other systems. In fact, the question may arise in every country about how the institutional framework for spatial planning should approach investments in renewable energy sources. In this approach, the adverse effects of the specific wording of the different spatial policy tools are particularly noticeable. It is also important to emphasise the dispersion of settlements in Poland, which in turn particularly conditions the implementation of investments in distributed energy [18].

It is in this context that it seems crucial to analyse the content of local spatial policy tools in force in Polish municipalities:

- studies of conditions and directions of spatial development
- and local spatial development plans.

The former should contain the concept of the local spatial policy but do not produce universally binding effects for investors. Only the local spatial development plans, which are not obligatory (i.e., the municipalities do not have to enact them), are generally binding law acts. The application of studies and plans is subject to numerous problems, especially the frequent lack of skills for local public authorities to implement vital spatial objectives [19]. The discussion on the implementation of renewables in spatial policy tools cannot be separated from the problems identified.

Besides, terminological discrepancies (in the sphere of specialist and legal language) very often at least delay the implementation of numerous investments [20]. It should be emphasised that when interpreting legally unclear terms, the universal problem of the relation between the rights of the property owner and the objectives of spatial policy recurs [21,22]. It also applies to the case of including renewable energy sources in planning acts.

This paper's analysis of spatial policy acts allows for a more in-depth presentation of the diversity of local approaches to renewable energy sources in the spatial policy. The analysis of such many spatial policy acts (over 12 thousand acts) in the present context has been carried out for the first time in Poland. Also, in the international literature, there is a lack of such approaches. Therefore, conclusions resulting from this study should be considered necessary for a broader discussion on the development of renewable energy sources and the optimal shaping of spatial management systems. The paper proposes a methodology for studying spatial policy tools (which, after adaptation, can be applied to other countries). In the authors' opinion, both the proposed methodology and the conclusions of the conducted analyses are new and essential contributions to the scientific discussion.

The scientific dimension of the subject needs to be emphasized. The authors are convinced that it is very important. Firstly, the publication profoundly contributes to the discussion on the diversity of national spatial planning systems, supplementing it with an important specialist context. Secondly, it significantly complements the description of the relationship between organization (including local and regional location) renewable energy sources and spatial planning by adding very extensive research material. Third, on the basis of the research carried out, it was possible to diagnose research problems concerning other thematic spheres as well (among others: differences between urban, rural and transitional areas, planning culture at different levels of public authorities, relations between regional and local authorities).

The aim and general assumptions of the research are outlined above. The second chapter reviews the literature. The focus is on how renewable energy sources are perceived in the context of spatial planning. Based on the review, key issues are presented. The principles in the Polish spatial planning system are also explained. The third chapter presents the research methods and specifies what exactly the research consisted of. The research results are presented in chapter four. There are 4 figures and 2 tables, along with explanations. Chapter 5 contains a discussion of the results. The obtained results are commented and confronted with the theses of the literature on the subject. New research directions have also been indicated. The summary and most important conclusions are included in the Conclusions.

2. Renewable Energy Sources and Spatial Policy Tools

The issue of renewable energy sources in the context of spatial planning is addressed in various ways in the literature. It is because it is the framework of a country's spatial planning system that significantly influences the feasibility of investments, including those in renewable energy sources. For several years, some literature has emphasised the need to adapt spatial planning more broadly to emerging challenges [23–25]. However, it is essential to note the substantial variation in individual national systems [26]. On the one hand, the scope and degree of development of renewable energy sources vary between countries, and on the other hand, the planning systems of individual countries are enormously different. The differences between spatial planning systems are very large, and their comprehensive coverage would require separate analyses. However, some examples relating to the European Union can be given. In the United Kingdom, we have a development-based system in which spatial plans have only an instructional role. In the Netherlands and France [27,28], for example, plans as binding acts play a much different role, explicitly limiting unwanted development. In the Central and Eastern European countries, the dominant approach is one in which there are two types of plan (general and specific). However, they play a lesser role than in Western Europe. This is due to the weaknesses and limited effectiveness of planning regulations defined in the literature of many of these countries [29–31]. The adaptation of systems to the new challenges will therefore vary. It is because the differentiation concerns both the adopted model of the spatial policy system and the status and advancement of the implementation of renewable energy sources.

A comparative study on European countries [32] shows that only about a quarter of the countries found the integration between the two areas indicated at the local government level. The dominant problem is the lack of joint action between these sectors [33–35]. Asarpota and Nadin [36] argue that the relationship between spatial planning and renewable energy sources is an essential, multifaceted issue. Variations in the physical and spatial characteristics of a city are related to the energy sector. It is evidenced by the increased demand for space following an increase in the share of renewable energy sources in the energy mix. The authors draw attention to the need for changes in the built environment to facilitate energy efficiency and argue for more frequent incorporation of innovation in spatial planning.

Focusing on small-scale wind turbines, Teschner and Alterman [37] point to the danger that an opaque legal and planning framework may discourage these investments. They treat wind turbines as a new item on the urban planning horizon, unsuited to prolonged procedures and provoking spatial conflicts. The authors highlight the diversity of approaches in different countries, citing micro-installation requirements in the UK and New Zealand. They propose the integration of strategic and experimental approaches for small wind turbines in the built environment. Alonzo [38] diagnosed as a critical contrast between spatial planning and energy scenarios in Italy the problems related to the objective of improving the natural gas distribution network (conflicting with the objectives of increasing renewable energy production and reducing CO_2 emissions). Nadai and Labussiere [39] cite the example of France and attempt to designate wind energy zones linked to the intention to shape investment in renewables from below. Morello et al. [40], referring to the example of Milan, highlight the role of metropolitan areas (not the territorially limited cities themselves) in shaping renewables. The relationship between renewables and spatial planning was also analysed for Flanders [41]. It should be emphasised that the referred publications analysed mainly specific case studies and provisions of selected individual spatial policy tools. However, the content of spatial policy tools for the whole country was not verified. The literature has addressed the relationship between spatial planning and wind turbine siting in less general and more specific terms. However, there is no broader consideration in such cases, but rather a description of the legal framework in a given country and individual practices [42,43].

The call for a more comprehensive implementation of renewables in spatial planning systems needs to be linked to discussing these systems' key challenges and issues, particularly in applying spatial policy tools. The objectives of spatial planning systems are related to ensuring optimisation and improvement of land use efficiency [44,45]. At the same time, it is associated with numerous sectoral perspectives and policies [46]. Therefore, spatial policy tools are assigned diverse tasks, both material and procedural [47].

The key tools at the local level are land use plans, and they vary in scope and formulation across countries [48]. One of the vital ongoing debates in the literature on this issue concerns their legal formulation: whether they should be generally binding acts or rather a set of guidelines [49–51] and whether they should be more general or specific acts [52–54].

Such dilemmas translate to some extent into the Polish spatial planning system. At the local level, there are two tools:

- strategic studies of spatial development conditions and directions
- and universally binding but optional local spatial development plans [55,56].

If no zoning plan is in force for a given area, the investment is implemented based on a decision on land development conditions. Regarding these decisions, the municipality does not influence their prior planning (the investor applies to the decision). Moreover, not all investments in renewable energy sources can be realised because of the decision on outline planning and spatial development—e.g., wind power plants can only be built based on the spatial development plan. This article verifies conscious local spatial policy, and the decisions in question are therefore not included in this scope.

Studies of spatial development conditions and directions, which theoretically should contain the concept of the municipality's spatial policy, often fail to fulfil their role by containing too many general provisions. If local plans are not adopted for the areas, the provisions of the spatial development conditions and directions studies are not implemented to any significant extent [57].

On the other hand, local spatial development plans (which must be consistent with the content of the studies) already contain generally binding standards. They specify their development's land use and detailed principles, including development parameters [58]. However, they also vary in quality [13,59]. Instead of protecting the spatial order, they often contribute to exacerbating the spatial chaos (e.g., by overspending on land for development and thus dispersing it). Furthermore, they contain provisions referring to diverse disciplines. These provisions turn out to be ambiguous at the stage of formal

and legal interpretation of their content and are often abused from the perspective of the original assumptions.

The mere fact that a particular designation is included in the spatial policy instruments does not guarantee that it will be realised. The study of spatial development conditions and directions, due to its non-binding nature—contains only a concept of the municipality's spatial development [60]. The inclusion of a specific development in the study means that the municipal authorities take this context into account in their development concept (this is of great value from the perspective of strategic planning). On the other hand, the inclusion of specific development opportunities in the spatial development plan means that a given development opportunity is actually created. However, there is no obligation to implement it [61]. This is how spatial planning in the context of renewable energy sources should be viewed: as an indirect or implicit determination of the feasibility of specific investments. It is one thing to have these possibilities and another to actually carry out the investment. However, it is clear that spatial planning is largely responsible for how quickly and to what extent the specific investments are made.

The above problems translate into conditions for the implementation of renewable energy sources. The analysis by Szyba [62] shows that investments in renewable energy sources can be realised in sparsely populated areas (areas with large farms) in the Polish space. Nevertheless, currently in such areas, scattered residential development is found, blocking opportunities for more significant renewable energy generation. A weak planning framework, generating spatial chaos, thus further hinders the goal of a climate-neutral economy in Poland. Furthermore, even adopting a spatial development plan does not guarantee that investment in renewable energy sources will be carried out without hindrance. Indeed, the terminological inconsistency of planning acts is also a blocking factor here [63].

In Poland, therefore, there are also problems diagnosed in other countries regarding the relationship between renewable energy sources and spatial planning. There is a lack of clarity in including the indicated investments in planning acts, an integrated planning concept, and a comprehensive (at the local level) reflection on the consequences of implementing renewable energy sources. Nevertheless—with so much conceptual chaos—renewable energy sources are included in local spatial policy tools. It seems entirely justified to verify how municipalities approach this issue.

3. Methods

The choice of methods results from the adopted research objective: to determine the role and formula of investments in renewable energy sources in Poland's concepts of the local spatial policy. The concepts referred first to the way renewable energy sources are included in the local spatial policy tools. How renewable energy sources were included in the studies of conditions and directions for the spatial development of municipalities should demonstrate the general approach of the given local government towards the indicated investments. It may be recalled that studies of spatial development conditions and directions are conceptual documents. Therefore, the verification concerns whether (and if so, how) renewable energy sources are considered in the concept of the local spatial policy. In turn, how local spatial development plans are incorporated translates into direct legal consequences and the sphere of planning implementation. It is because the plans are the basis for construction decisions.

For the purpose of the analyses, a search was done for documents in 1447 Polish municipalities (58.4% of the total). These were all municipalities in which the studies of spatial development conditions and directions in any way addressed the issue of renewable energy sources. It should be emphasised that there is no reference to the indicated issues in the remaining municipal studies. Thus, only in the studied 1447 municipalities can a defined, articulated concept of spatial policy linkage to renewable energy sources be found. The content of the studies of spatial development conditions and directions in the indicated communes was analysed from the perspective of:

- the way in which renewable energy sources were included (full investment permit, partial permit or general wording);
- degree of detail in approach to renewable energy sources;
- date of adoption of the respective study of spatial development conditions and directions.

The analysis considered all local planning acts in force in the municipalities, regardless of the date of their adoption (a total of 12,777 local planning documents were analysed). The indicated spatial planning instruments are enacted in municipalities. Each municipality must obligatorily adopt a study of spatial development conditions and directions. On the other hand, the adoption of local spatial development plans (including their number) depends on the discretion of the municipality. The number of spatial planning instruments obtained is the sum of all spatial planning instruments in force in all surveyed municipalities. Nevertheless, from the perspective of the date of enactment of the acts, two periods were distinguished. The year 2016 was defined as the cut-off date considered in the research, as it was in that year that the Act on investments in wind power plants [51,64] was enacted in Poland, seriously changing the planning conditions for the implementation of these investments. This act introduced serious barriers to wind power investments. Their location became possible after meeting new stringent minimum distance requirements from residential development. The Act has seriously changed the debate about all wind turbine siting investments in spatial planning.

All existing local spatial development plans related to renewable energy sources were also analysed in the indicated municipalities. Two categories of plans were distinguished:

- plans (including amendments to plans) entirely devoted to uses related to the execution of investments in wind power plants (there are 529 plans in total);
- plans (including changes to plans) cover other purposes and provide the possibility of locating investments in wind power plants—mainly micro-installations (there are 9132 such plans in total).

First, the number of plans enacted in individual communes was verified. Furthermore, plans enacted until the end of 2015 and plans enacted from the beginning of 2016 were singled out. Within the second of the singled out categories of plans, a subgroup was singled out—local plans with the residential use of micro-installations. The context of linking the implementation of renewable energy sources with barriers and benefits regarding housing development also seems particularly relevant in international discussion.

Materials were collected in a variety of ways. Some studies of conditions and directions of spatial development are available on the website of individual communes. It was therefore possible to download them from there. However, in the case of 63 municipalities, studies were not available in this manner. They were obtained from the authorities of individual municipalities via e-mail correspondence. On the other hand, local spatial development plans are generally binding acts. As such, they are published in the provincial official journals of the respective provinces. The provincial official journals were searched and on this basis local spatial development plans were collected (including those currently in force). Based on this, two Excel databases were developed, concerning (1) studies of spatial development conditions and directions for municipalities and (2) local spatial development plans, containing RES characteristics in these documents (e.g., volume and detail of RES text, type of installations, year/period of legal changes, etc.). These data were then visualised for municipalities in Poland in the MapInfo Professional program, using, among others, own digital vector underlays held by the Institute of Geography and Spatial Organization of PAS. Moreover, in the statistical part concerning the whole country (correlation analysis), data coming from the annual survey in communes, conducted since 2005 by Statistics Poland and the ministry responsible for the department "Construction and Spatial Management", were used. (in 2021 it was the Ministry of Economic Development and Technology). The data concerned, among other things, the area of local plans in force in municipalities. The information collected is statistically capturable. The features of the documents were analysed according to geographical location and types of municipalities. The classification made for the purposes of spatial planning monitoring [61] was used. In

this classification, ten types of municipalities were distinguished, in which urban centres form the "backbone" at different levels of the administrative-functional hierarchy (voivodeship cities, subregional cities, local multifunctional cities), and the remaining types were separated based on socio-economic functions and morphological features (municipalities in suburban areas, transport corridors, tourist areas, rural areas with intensive agricultural development, extensive agricultural use, with a vital nature protection function).

In addition, the main trends related to the way planning regulations for renewable energy sources are constructed, were verified as part of the qualitative analysis.

4. Results

4.1. Regional and Functional Regularities

4.1.1. Studies on Conditions and Directions for the Spatial Development of Communes

The spatial diversity of RES-related indications in gminas' spatial development conditions and directions is presented on the map in Figure 1. In general, these indications are most significant for Małopolskie, Mazowieckie and Pomorskie voivodeships, and least significant for Kujawsko-pomorskie, Podlaskie and Świętokrzyskie. In this respect, the Mazowieckie and Małopolskie Voivodeships stand out clearly from the neighbouring Voivodeships, which would indicate a standard policy of gminas within one region.

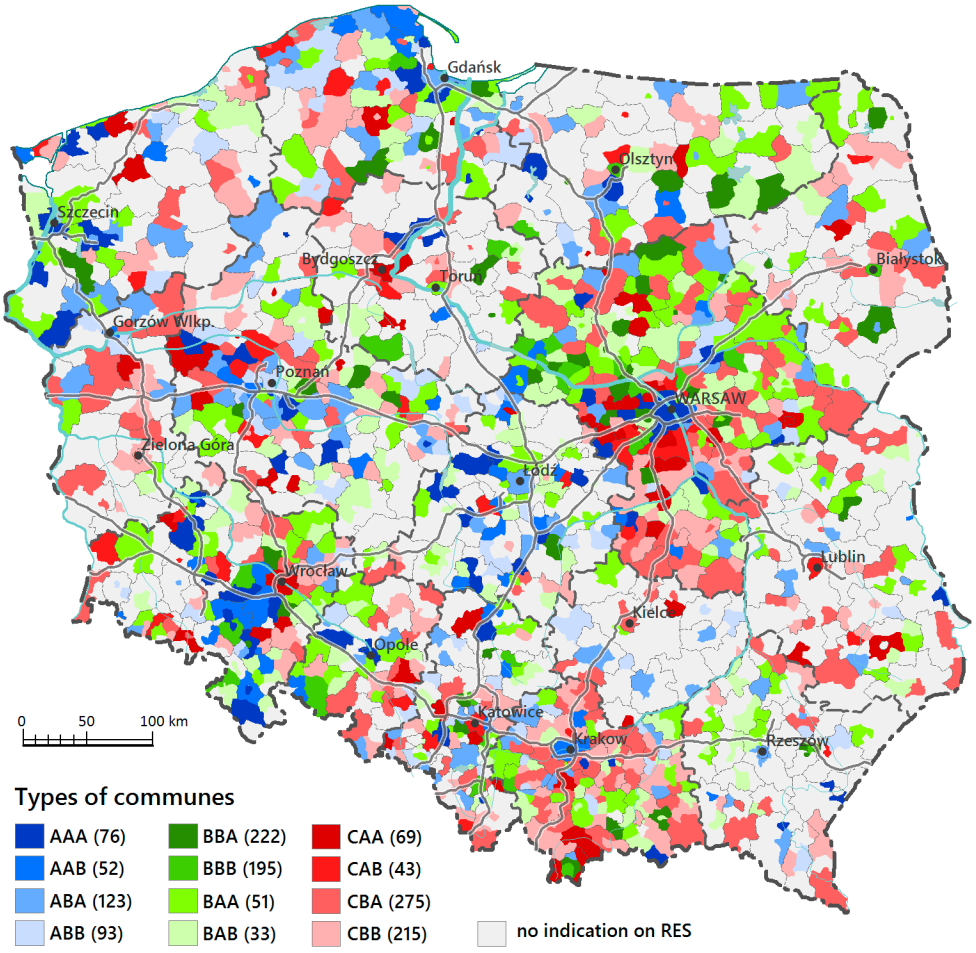

Figure 1. Typology of municipalities in terms of characteristics of municipal (commune) studies for indications of renewable energy sources.

Explanations:

1—the letter in the first place indicates how the studies approach RES—whether and how they permit implementation:

A—universal renewable energy consent documents,

B—authorisation documents for renewable energy sources up to 100 kW,
C—documents containing general provisions;
1—the letter in the second place indicates the volume of provisions in RES studies, i.e., whether much or little space has been devoted to this issue:
A—documents with extended passages on renewable energy sources,
B—documents with short extracts on renewable energy sources;
3—the letter in the third place indicates the period in which the study was adopted:
A—documents adopted/updated by the end of 2015,
B—documents adopted/updated as of 2016.

The map in Figure 1 furthermore reveals a large mosaic of indications in terms of different characteristics of RES indications, such as the approach ("width" of possibilities to locate RES), the amount of space in the documents, or the time of introduction of the findings in the documents. Out of 1477 municipalities where there were references on RES in the studies, 344 documents (23.8%) had permits for all RES investments, another 501 (34.6%) had permits for RES investments only up to 100 kW (i.e., only for smaller RES), and 602 municipalities had only general analyses without specifically formulated conclusions. Regarding the volume, only in 324 municipal studies (22.4%), there were more or less elaborate sections on RES, and in the rest, up to a few sentences. On the other hand, according to the time of enactment or update of the study, for 816 municipalities (56.4%), this happened by the end of 2015, and for the rest between 2016 and 2020.

An analysis of the content of municipal studies in terms of references to RES by type of municipality provides interesting regularities (Figure 1). It turns out that it was most common in urban areas (types A, C and E—86–91%), followed by suburban areas (type B—74% and D—60%). The next group were more urbanised municipalities (industry, transport functions, tourism—at a similar level as suburban zones of medium-sized cities—59–61%). RES issues were raised least frequently in all typical rural municipalities (HIJ—47–52%).

There were significant differences in terms of RES development opportunities in the distinguished types of municipalities in terms of RES development opportunities (Table 1, Figure 2). The most significant opportunities existed in provincial towns (46.7%), followed by local towns in type E (36.9%). In the other types of municipalities, it was 17–25%. In large cities, there were also the fewest restrictions related to the power of installations up to 100 kW—16.7%, while in the remaining types of municipalities, this value exceeded 25% and reached up to 40%. At the same time, RES issues in rural areas were the most laconic.

Table 1. Characteristics of references to RES in studies of spatial development conditions and directions of municipalities.

Type of Communes	Municipalities (Communes)			K1 (Permission)			K2 (Volume)		K3 (Period)	
	Total (Number)	with References to the Study		a	b	c	a	b	a	b
		Number	%	% (Municipal Studies with References to Renewable Energy Sources)						
A	33	30	90.9	46.7	16.7	36.7	56.7	43.3	50.0	50.0
B	265	195	73.6	21.5	34.9	43.6	32.8	67.2	54.4	45.6
C	55	48	87.3	25.0	37.5	37.5	35.4	64.6	52.1	47.9
D	201	120	59.7	28.3	37.5	34.2	25.0	75.0	55.8	44.2
E	142	122	85.9	36.9	27.0	36.1	28.7	71.3	60.7	39.3
F	137	81	59.1	22.2	29.6	48.1	21.0	79.0	61.7	38.3
G	222	136	61.3	21.3	36.0	42.6	24.3	75.7	58.1	41.9
H	496	236	47.6	17.4	40.3	42.4	16.9	83.1	61.4	38.6
I	665	348	52.3	24.7	37.4	37.9	14.9	85.1	52.9	47.1
J	261	131	50.2	17.6	26.0	56.5	14.5	85.5	54.2	45.8
Total	2477	1447	58.4	23.8	34.6	41.6	22.4	77.6	56.4	43.6

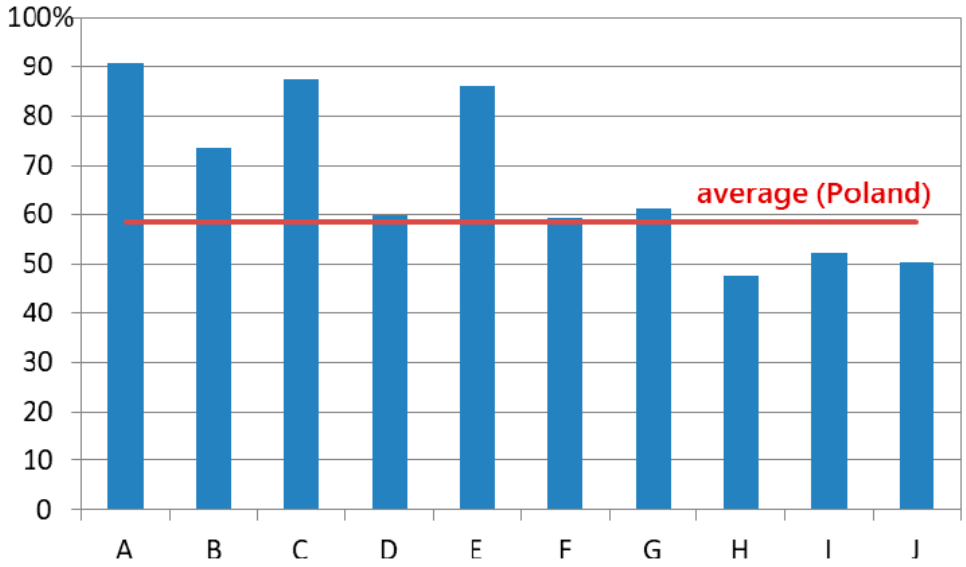

Figure 2. Share of municipalities in which references to RES existed in the existing spatial development conditions and directions.

It is also worth noting that the highest volume of documents is also related to cities and in the highest category. In provincial cities, as much as 56.7% of RES descriptions were extensive, while in other types of municipalities, it was usually 15–30%. On the other hand, there were no significant differences regarding the date of enactment of the municipal study—here, the location within a particular province played a more significant role.

Abbreviations: A—functional urban areas of voivodeship capitals; B—their external zones; C—functional urban; areas of subregional centres; D—their external zones; E—multifunctional urban centres; F—municipalities (communes) with developed transport functions; G—municipalities with other developed non-agricultural functions (tourism and large-scale functions, including mining); H—municipalities with intensively developed agricultural functions; I—municipalities with moderately developed agricultural functions; J—extensively developed municipalities (with forests or nature protection areas).

Classification based on Śleszyński and Komornicki, 2016 [65].

Explanation of abbreviations: as in Figure 2.

4.1.2. Local Development Plans

At the end of 2020, 529 local plans for wind turbines were in force. They were mainly concentrated in the Lower Silesian Voivodeship, south and west of Wrocław (Figure 3). They were also more frequent in the central, western and northern parts of the country, e.g., Pobrzeże Bałtyckie (Baltic Coastland), Pomorze Gdańskie (Gdańsk Pomerania), Lubuskie (Lubusz) and Łódzkie (Łódzkie), but very rare in Podlaskie and Podkarpacie. The concentration of local plans in the Wrocław metropolitan area meant that the suburban type covered as much as 26% of locations (Table 2).

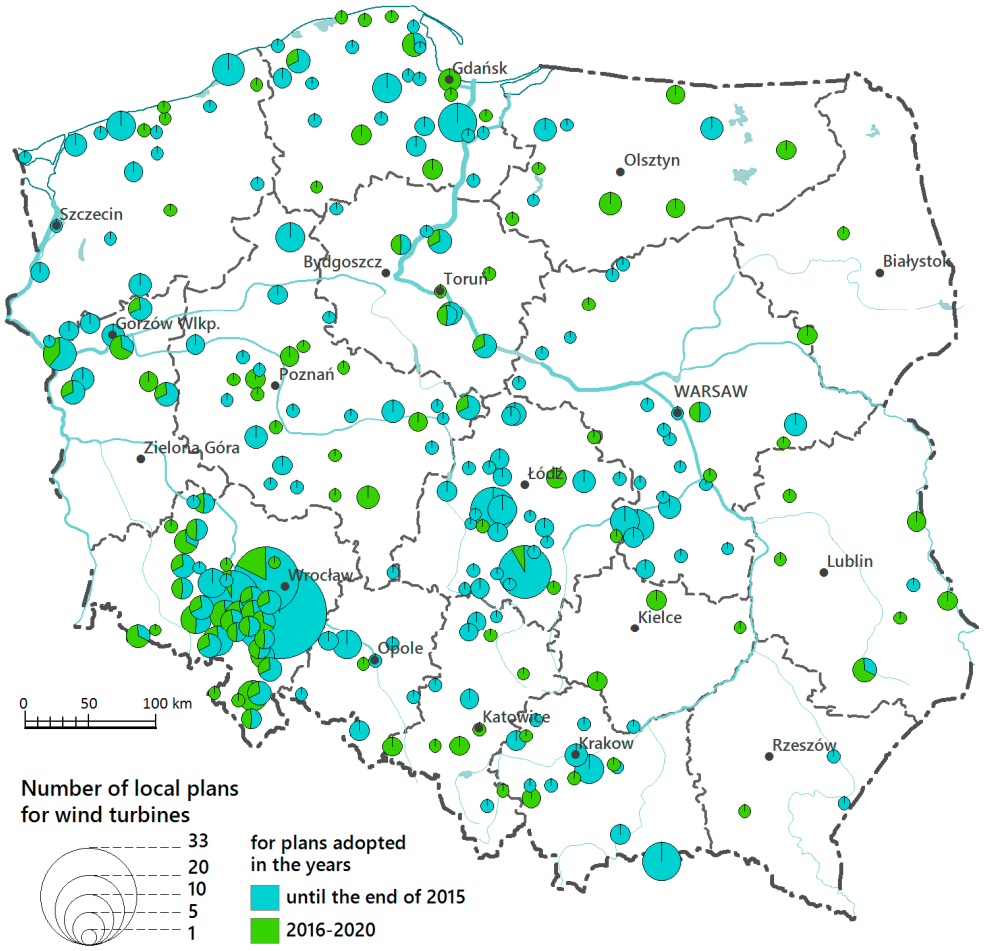

Figure 3. Location of local plans for wind farms in late 2020.

Table 2. Characteristics of local plans in terms of arrangements concerning renewable energy sources.

Type	Local Plans with Arrangements for Renewable Energy Sources						
	Total			of Which Wind Power Plants (Number)	of Which Micro-Installations		
					Number	of Which for Housing	
	Number	%	Share of Findings from 2016			Number	%
A	1285	6.5	41.6	14	740	531	71.8
B	5159	26.2	46.8	104	2878	2177	75.6
C	1063	5.4	43.3	28	597	438	73.4
D	1308	6.6	43.3	50	700	558	79.7
E	1573	8.0	48.3	51	856	666	77.8
F	941	4.8	51.4	67	494	380	76.9
G	1732	8.8	46.7	54	944	734	77.8
H	2126	10.8	52.4	47	1151	928	80.6
I	3426	17.4	50.1	95	1858	1473	79.3
J	1084	5.5	47.8	19	583	482	82.7
Total	19,697	100.0	47.6	529	10,801	8367	77.5

Concentration in suburban zones also concerned micro-installations (Figure 4). Suburban zones accounted for 27% of local plans (Table 2). This type of RES also primarily concerned rural types of municipalities (HIJ—33.3%). In nearly 78% of cases, micro-installations were related to housing. No significant variations within municipality types were detected. Similarly, no relationships were detected with planning coverage, average plan size, etc.

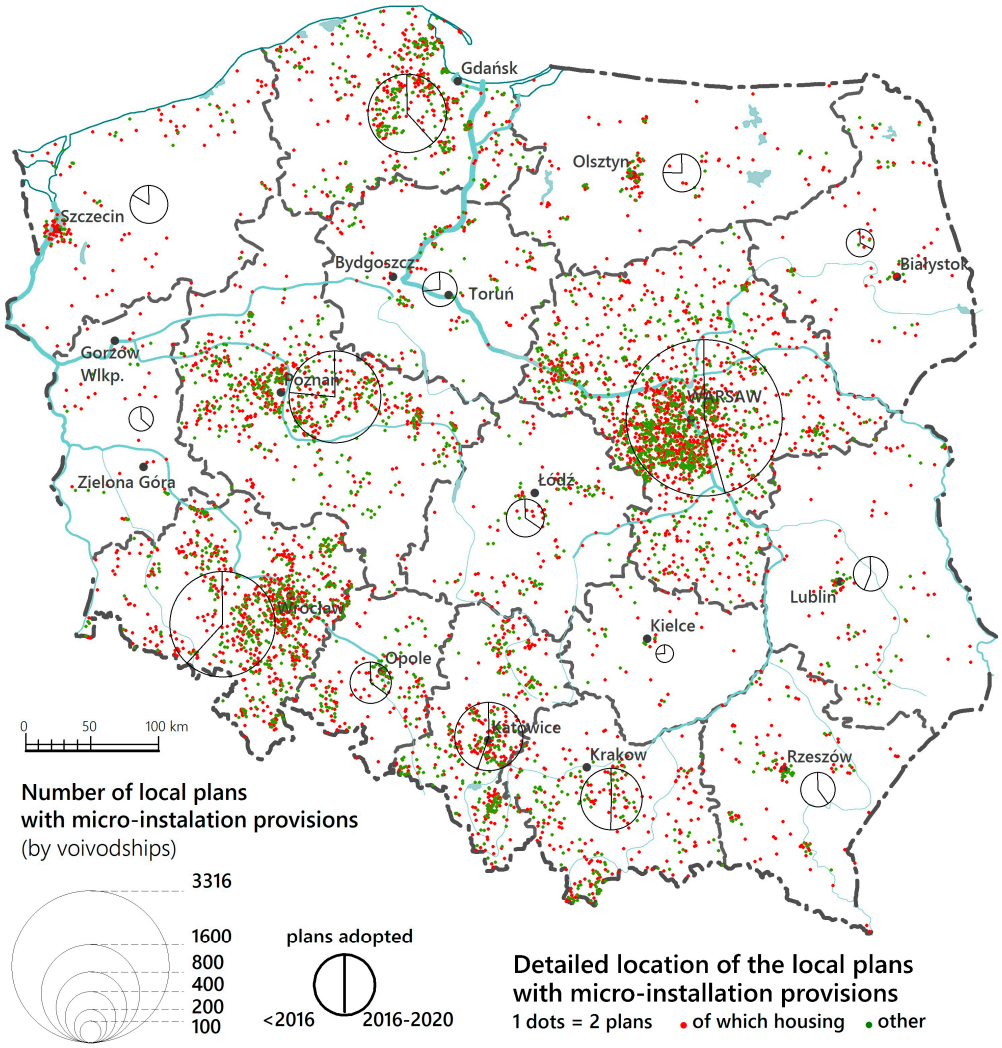

Figure 4. Location of local plans, in which arrangements related to micro-installations were made at the end of 2020.

Some weak differences were detected for the period concerning the introduction of micro-installation records. In general, in the less urbanised municipalities the percentage of these provisions was higher after 2015 than before. However, these differences are not large. In the case of the largest cities (type A) in the second later period it was 42.0% of installations, in medium-sized cities (type C)—42.7% and in local towns (type E)—47.1% At the same time in extensively developed municipalities (type J) it was 46.8%, in municipalities with a moderately developed agricultural function (type I)—48.3% and in municipalities with a strongly developed agricultural function (type H)—50.7%.

Such a diversification does not suggest a regularity consisting in a directly proportional character of the relation between the time of introduction of RES installation arrangements and the rurality level of the municipality (or inversely proportional to the urbanisation level). Thus, the caesura of 2015/2016 did not prove to be a breakthrough in terms of impact on the development of renewable energy sources in different types of areas.

While the 2016 statutory changes did not affect adopting spatial planning studies or local spatial plans with micro-installations, a significant difference can be noted with plans for wind power purposes. As of 2016, only 29.5% of the total number of all existing spatial development plans have been adopted (and it is worth adding that a large proportion of the plans were adopted while the transitional provisions were still in force). It means that at a time when wind power investments are needed, the planning basis for their implementation has become considerably weaker. The legislator wanted to counteract

certain dangers—excessive concentration of wind power investments and complete disregard for the voice of local communities. Nevertheless, through the current solutions it has led to an exaggeration in the other direction. It is more important as only spatial development plans have become the only possible basis for investments. Strict provisions of the Wind Power Plants Act were justified by social considerations and the need to protect residential development. However, the solutions turned out to be inadequate. Moreover, they introduced many more (completely unnecessary) legal dilemmas.

In the analysed planning acts, renewable energy sources are presented in various ways. The most significant conceptual chaos can be found in the studies of spatial development conditions and directions. Terms concerning, for example, wind power plants are very diverse and accessible. This problem also occurs concerning local spatial development plans, but it is not much greater than the typical terminological problems concerning the content of Polish spatial development plans. However, in the case of micro-installations, two main trends can be identified:

- short permission for the location of renewable energy sources, without adding any guidelines;
- short recommendation to use renewable energy sources—and even a slogan listing their types (e.g., "solar energy, ground heat energy, biomass, including wood").

5. Discussion

The conducted research is a critical reference point for numerous directions of scientific discussion concerning the development of RES. First, it seems crucial to verify the comprehensive approach of municipalities to the issue of renewable energy sources in spatial planning. It was found that a conscious and defined approach to this issue is present in 58.4% of Polish municipalities. The remaining municipalities are, of course, also involved in the renewable energy sources issue (e.g., when issuing decisions on land development conditions), but they do not include it in any way in their strategic spatial development directions. Many municipalities can't implement the postulates of wider integration of development policies in this situation. It is worth recalling the broader inclusion of sectoral policies in spatial planning postulated in the literature [46]. The prospect of realising renewable energy sources can also be treated in this context. The information about such a relatively small number of municipalities integrating renewable energy sources into spatial development concepts helps to take a broader look at the barriers related to the integration of development policies. They are high, especially in weak planning systems. The solution to the problem cannot be legal changes alone. The study documents that even if municipalities include renewable energy sources in their spatial development concepts, it is not tantamount to the integration of development policies. Often the inclusion of information on renewable energy sources in the spatial development conditions and directions studies is very general. The key is to increase the planning culture in the community. Integrated development planning is addressed in different ways in the literature (New Vocations). For example, broader systemic (e.g., fiscal) directions for improving the present state are indicated [66]. However, based on the research results, it can be concluded that the first step is first to include these issues in the conceptual documents themselves. Secondly, it is necessary to ensure that this inclusion is as concrete as possible from the perspective of the direction of further action. In this context, the case of Poland shows that in numerous municipalities, the role of renewable energy sources is formulated very generally. So, even if the study of conditions and directions of the spatial development of the municipality refers to this issue, there is no guarantee that any conclusion will result from such a reference. The research carried out for this publication shows that in a country with less developed renewable energy sources, the problems are multifaceted. These problems include the weakness of the spatial planning system.

The above is an example of the tendency noticed in the literature, according to which, when creating the legal and planning framework for renewable energy sources, there is a lack of precision of individual expressions [63]. In this respect, the findings of Teschner and

Alterman [37] should be confirmed. To improve this state of affairs, it would be advisable to prejudge in more detail the opportunity of locating renewable energy sources and possible related constraints [67]. It should also be based on a broader justification beyond the spatial sphere. In the surveyed group, only 22% of the surveyed municipalities met these requirements. This trend confirms observations that in many countries, renewable energy is still not sufficiently considered a factor of local development, helping to achieve greater efficiency of socio-economic systems, household savings, etc. [68].

The presented results of the study make it possible to determine which municipalities (from a geographical perspective—distribution in different regions of the country and from a typological perspective—their settlement and socio-economic types) are most interested in the planning dimension of renewable energy sources. In this context, it was detected that especially the location of local plans, where arrangements related to micro-installations were made, was related to provincial borders. It may be due to the spatial policy of the province. The province cannot directly impose specific planning provisions on municipalities regarding renewable energy sources in the Polish legal system. Nevertheless, the concept of cooperation of public authorities in spatial planning [69,70] is confirmed in this case. It is especially true where the legal framework (as in the case of renewable energy sources in Poland) is not sufficiently clear.

Moreover, it was detected that RES-related solutions are statistically more frequent in planning acts in urbanised areas and least frequent in typically rural areas. It can be explained in two ways. Firstly, there is a higher demand for energy in cities, which favours this type of solution. Secondly, cities have a greater awareness of local authorities and better-specialised facilities to implement this type of solution. Asarpot and Nadin [36] argue about the role of energy in the built environment and the desire of cities to improve energy efficiency. Better spatial bias for energy in cities is, of course, not a general rule for other aspects of spatial policies. It is often in urban and peri-urban areas that the most dangerous phenomena from the perspective of spatial order protection occur (also stimulated by local spatial policies) [60]. The indicated trends—concerning both cities and suburban areas—confirm the thesis of Morello et al. [40] on the necessity to consider (from the perspective of renewable energy sources) entire metropolitan areas. In Polish conditions, institutional solutions concerning metropolitan areas are definitely lacking [71,72]. Thus, this is a problem also in the sphere of shaping renewable energy sources.

When analysing the results, it should also be remembered that while local spatial development plans with micro-installations should be assessed unequivocally positively, clusters of spatial development plans for wind power investments do not always deserve such an assessment. They should be implemented—and their apparent lack is a problem in many places. However, excessive clusters of plans providing for the location of such investments are also a problem. All the more reason to designate (but at least on a regional scale) a wind energy zone [39].

The results of the study lead to another important conclusion. The research shows that 78% of local spatial development plans providing for the location of micro installations are linked to determining the residential designation of land. Therefore, it can be assumed that renewable energy sources are significantly associated with housing issues in Polish spatial planning conditions. Microinstallations of renewable energy sources may be treated as an element of the housing policy (in the sense of providing specific valuable goods). This viewpoint broadens the definition of the impact of renewables on cities [36]. However, for renewable energy investments, housing considerations constitute a significant barrier to development. It has been especially so since the beginning of 2016, i.e., d the enactment of the law introducing severe minimum distance restrictions for wind turbines from residential development. The relationship of spatial planning, renewables and housing policy is thus more intricate than portrayed [63]. For both these reasons, there is a requirement to integrate the discussion of the planning dimension of renewables more broadly with the discussion of housing policy.

Attention should also be paid to the role of legal regulations in the planning dimension of renewable energy sources. The study shows that:

- strict legal regulations, intended by the legislator to limit specific investments, at the implementation stage may turn out to be a factor excessively blocking these investments;
- attempts related to the inclusion of renewable energy sources in planning acts remain diverse, uncoordinated and chaotic (which confirms and develops the theses of) [69].

The above can be applied to the discussion of the diverse national spatial planning systems. Here, one can recall the current criticising overly detailed regulations blocking development [52–54]. The case of the 2016 Polish law on renewable energy sources is a good confirmation of the concerns expressed. However, using this example, it must be added that the fear of excessive regulatory detail cannot be equated with the absence of legal restrictions in spatial planning. Indeed, in countries with a low planning culture [73], there is a risk of overinterpreting many less specific planning provisions [74,75] and, as it were, provoking ambiguities and conflicts from below on this basis. Optimally, the scope of constraints is derived from analyses linked to integrated planning.

As indicated in the literature review, there have been no similar studies on other countries to date. The studies referred more to individual case studies (for example, one or more planning acts) and also reference to individual practices. Of course, as indicated in the literature review, also those studies had significant conclusions. Nevertheless, having carried out the analysis for the purposes of this article, it is worth highlighting further research questions for analysis. A comprehensive analysis of spatial policy instruments in other countries would be very valuable. Despite the differences between these instruments, it will be possible to make further comparisons (this will also be beneficial for the diagnosis of the challenges in the country itself). Of course, a comparison of spatial policy instruments alone is not sufficient. The extent to which municipalities are interested in the spatial dimension of renewable energy sources needs to be verified (considering the legal possibilities in the country in question). The research also leads to the conclusion that the differences between urban and rural areas need to be particularly looked at in this respect. An interesting question is whether the trends observed in Poland will be repeated. Another interesting aspect (arising from the research) is the relationship between regional and municipal authorities. It is worth verifying how they influence the formation of local spatial policies on renewable energy sources. In Poland, a dependence of the municipalities' approach to this problem on their location in a particular voivodeship was found. This gives some basis for consideration of public governance. The study inspires one more research direction—a broader analysis of spatial conflicts concerning renewable energy sources. The literature on spatial conflicts is very extensive [76–78]. The topic of renewable energy sources is another one that should be taken up in this context.

6. Conclusions

The study leads to several important conclusions. Based on the research, it can be confirmed that there are serious deficiencies in spatial policy in Poland regarding renewable energy sources. It is astonishing that in almost 50% of municipalities, renewable energy sources are not included in any way in strategic spatial planning tools. It should be noted that in Poland, the state of renewable energy implementation in the planning dimension is definitely insufficient in typically rural areas. It applies especially to the northern part of the country, where the dispersion of settlements is the greatest and where the need for installation of renewable energy sources is also the greatest, especially in the situation of low emissions from boilers and cookers fired by wood and coal. A major weakness is being diagnosed here, which, incidentally, can be linked to other weaknesses in spatial policy in rural areas.

The results illustrate the severe scale of this problem. The problem should be resolved not from the bottom up (from the commune perspective), but from the national perspective. There is another problem here—the discrepancy in terminology between the professional

perspective (on renewable energy sources) and the planning perspective. Municipalities in spatial policy instruments cannot cope with this discrepancy.

Another research conclusion is that spatial policy concerning arrangements related to micro installations in spatial development plans is uneven in different local government units (also on a regional scale) and needs to be unified. This harmonisation should consist of a broader introduction of micro-installations into spatial development plans and similar planning formulations. There is another problem here—the discrepancy in terminology between the professional perspective (on renewable energy sources) and the planning perspective. Municipalities in spatial policy instruments cannot cope with this discrepancy. In some regions of Poland, there seems to be too much saturation with changes in plans allowing for the construction of wind turbines (especially the area south and west of Wrocław). It threatens to deteriorate the aesthetic value of the landscape. On this basis, it can be concluded that the problem concerning the relationship between the spatial planning system and renewable energy sources is diverse. It is not only blocking investments in renewable energy sources. It is also allowing specific investments in many places in excess.

In conclusion, a problem in the Polish spatial planning system is the inadequate planning and legal framework for investments in renewable energy sources. This leads to some investments being blocked and to an increase in terminological confusion, which translates into barriers. On the other hand, especially in the case of higher capacity renewable energy sources, there is a risk of their excessive localisation in selected areas. The inefficiency of the spatial planning system in Poland is responsible for this, as its lack of control over spatial order leads to such effects.

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