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Research Article

The Perceived Role of Prosumer Energy in the Sustainable Energy Transition: Evidence from Rural Municipalities in Poland

Postrzegana rola energetyki prosumenckiej w zrównoważonej transformacji energetycznej – wyniki badań przeprowadzonych w gminach wiejskich w Polsce

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Abstract

The energy transition requires not only the development of renewable energy sources but also the active participation of local communities in energy production and consumption processes. In this context, prosumer energy is increasingly recognised as a key component of the sustainable energy transition. Despite the growing body of research on prosumerism, relatively little attention has been devoted to how its significance is perceived by local authorities, particularly in rural areas. The aim of this article is to identify how representatives of rural municipalities in Poland perceive the role of prosumer energy in the sustainable energy transition. The study employed a survey-based research design involving representatives of 518 rural municipalities. The analysis encompassed five dimensions of the energy transition: (1) the achievement of environmental and climate objectives, (2) energy justice, (3) environmental responsibility, (4) value conflicts, and (5) local communities' energy resilience. The findings indicate that prosumer energy is perceived as an important component of the sustainable energy transition in rural areas. Respondents attribute particular significance to its contribution to environmental protection, the reduction of greenhouse gas emissions, the strengthening of energy security, and the enhancement of local communities' resilience to energy crises. At the same time, the results reveal a clear asymmetry in perceptions of prosumer energy, with considerably greater importance attached to its environmental, energy-related and economic functions than to the social dimension of the energy transition. Respondents also recognise the risk of unequal access to the benefits of the energy transition, particularly for low-income households, older people, and residents of multi-family buildings. The article contributes to the literature on the energy transition by providing insights into the perspectives of representatives of rural municipalities and demonstrating that the social dimension of prosumer energy remains less prominent than its contribution to environmental objectives and energy security.

Keywords

prosumer energy, sustainable energy transition, energy justice, environmental responsibility, energy resilience, local government, rural municipalities, Poland, SDG 7 – Affordable and Clean Energy

Streszczenie

Transformacja energetyczna wymaga nie tylko rozwoju odnawialnych źródeł energii, lecz także aktywnego uczestnictwa społeczności lokalnych w procesach wytwarzania i zużycia energii. W tym kontekście energetyka prosumencka jest coraz częściej uznawana za jeden z kluczowych elementów zrównoważonej transformacji energetycznej. Pomimo rosnącej liczby badań poświęconych prosumeryzmowi stosunkowo niewiele uwagi poświęcono sposobowi postrzegania jego znaczenia przez przedstawicieli władz samorządowych, zwłaszcza na obszarach wiejskich. Celem artykułu jest identyfikacja sposobu postrzegania roli energetyki prosumenckiej w zrównoważonej transformacji energetycznej przez przedstawicieli gmin wiejskich w Polsce. Badanie przeprowadzono metodą sondażu diagnostycznego z udziałem przedstawicieli 518 gmin wiejskich. Analiza objęła pięć wymiarów transformacji energetycznej: (1) realizację celów środowiskowych i klimatycznych, (2) sprawiedliwość energetyczną, (3) odpowiedzialność środowiskową, (4) konflikty wartości oraz (5) odporność energetyczną społeczności lokalnych. Wyniki wskazują, że energetyka prosumencka jest postrzegana jako istotny element zrównoważonej transformacji energetycznej na obszarach wiejskich. Respondenci przypisują szczególne znaczenie jej wkładowi w ochronę środowiska, ograniczanie emisji gazów cieplarnianych, wzmacnianie bezpieczeństwa energetycznego oraz zwiększanie odporności społeczności lokalnych na kryzysy energetyczne. Jednocześnie wyniki ujawniają wyraźną asymetrię w postrzeganiu energetyki prosumenckiej, polegającą na przypisywaniu znacznie większego znaczenia jej funkcjom środowiskowym, energetycznym i ekonomicznym niż społecznemu wymiarowi transformacji energetycznej. Respondenci dostrzegają również ryzyko nierównego dostępu do korzyści wynikających z transformacji energetycznej, szczególnie w odniesieniu do gospodarstw domowych o niskich dochodach, osób starszych oraz mieszkańców budynków wielorodzinnych. Artykuł wnosi wkład do literatury dotyczącej transformacji energetycznej poprzez przedstawienie perspektywy reprezentantów gmin wiejskich oraz wykazanie, że społeczny wymiar energetyki prosumenckiej zajmuje mniej eksponowane miejsce w ich ocenach niż jej wkład w realizację celów środowiskowych i zapewnienie bezpieczeństwa energetycznego.

Słowa kluczowe

energetyka prosumencka, zrównoważona transformacja energetyczna, sprawiedliwość energetyczna, odpowiedzialność środowiskowa, odporność energetyczna, samorząd terytorialny, gminy wiejskie, Polska, Cel Zrównoważonego Rozwoju 7 – Czysta i dostępna energia

Introduction

The transition towards low-carbon and decentralised energy systems requires not only technological change but also the active involvement of citizens, local communities, and public institutions (Walker and Devine-Wright 2008; Wolsink 2012; Milčiuvienė et al. 2019; Parra-Domínguez et al. 2023). Within this process, prosumer energy has emerged as an important form of citizen participation in energy generation and consumption, with potential implications for environmental sustainability, energy security, social justice, and

local resilience (Milčiuvienė et al. 2019; Hoicka et al. 2021; Heffron 2022; Parra-Domínguez et al. 2023).

Rural areas constitute a particularly relevant context in which to examine these processes. On the one hand, rural municipalities often offer favourable spatial conditions and access to resources for the development of distributed renewable energy installations (Standar et al. 2021; Kozera et al. 2024; Neij et al. 2025). On the other hand, they may face specific challenges related to energy poverty, demographic ageing, limited household investment capacity, infrastructural constraints, and conflicts between renewable energy development and the protection of landscape and spatial values (Devine-Wright 2009; Hanke et al. 2021; Siciliano et al. 2021; Tirado-Herrero 2023; Lacey-Barnacle 2024). These characteristics make rural areas particularly important settings for examining whether the benefits and burdens associated with the energy transition are distributed equitably and whether decentralised energy development contributes to enhancing local adaptive capacity and resilience.

Despite the growing body of literature on prosumer energy, existing research has predominantly focused on individual households and prosumers, including their motivations, investment decisions, and energy-related behaviours (Palm 2018; Horstink et al. 2020; Hanke et al. 2021). Other strands of research have examined economic and regulatory determinants, public support mechanisms, social acceptance, and emerging forms of citizen and community energy (Parag and Sovacool 2016; Zdonek et al. 2022; Campos and Marín-González 2020; Parra-Domínguez et al. 2023; Neij et al. 2025). Relatively little attention has been paid to the perspectives of local governments, even though municipalities play an important role in shaping the institutional, spatial, informational, and organisational conditions within which local energy transitions unfold (Henrich et al. 2021; Rakowska and Ozimek 2021; Kozera et al. 2024).

The perspective of local authorities is particularly relevant because municipalities are not merely passive implementers of national energy and climate policies. They also influence local development strategies, spatial planning, environmental education, energy-efficiency initiatives, and the institutional conditions under which renewable energy projects are developed. In this sense, municipalities are important actors in local energy governance, mediating between national transition objectives, local development priorities, and the needs and capacities of local communities. Their assessments can therefore provide valuable insight into how prosumer energy is perceived by actors directly involved in the practical implementation of energy-transition policies at the local level.

Against this background, two research gaps can be identified. First, insufficient attention has been paid to how representatives of rural municipalities perceive the role of prosumer energy in the sustainable energy transition. Existing studies have tended to prioritise the perspectives of households, individual prosumers, investors, energy communities, or market actors, while the views of local-government representatives remain comparatively underexplored. Second, prosumer energy has rarely been examined within a single multidimensional analytical framework integrating environmental and climate objectives, energy justice, environmental responsibility, value conflicts, and local energy resilience. Addressing these dimensions jointly is important because the sustainable energy transition extends beyond technological deployment and decarbonisation to encompass questions of fairness, responsibility, social inclusion, institutional capacity, and the ability of local communities to respond to energy-related disruptions.

Accordingly, the aim of this study is to identify how representatives of rural municipalities in Poland perceive the role of prosumer energy in the sustainable energy transition. The study contributes to the existing literature in two principal respects. First, it incorporates the perspective of local-government representatives who are directly involved in shaping and implementing local development, environmental, and energy-related policies. Second, it examines prosumer energy through an integrated, multidimensional analytical framework that combines environmental and climate objectives with questions of energy justice, environmental responsibility, value conflicts, and energy resilience.

The study addresses the following research questions:

RQ1. Do representatives of rural municipalities perceive prosumer energy as an important component of the sustainable energy transition?

RQ2. How do representatives of rural municipalities assess the implications of prosumer energy for energy justice and residents' access to the benefits of the energy transition?

RQ3. Is prosumer energy perceived as contributing to environmental responsibility among residents, and how is the role of municipalities in promoting pro-environmental attitudes assessed?

RQ4. Which values are prioritised by representatives of rural municipalities when environmental, social, spatial, and economic objectives of the energy transition come into conflict?

RQ5. Is prosumer energy perceived as a factor that strengthens the energy resilience of rural communities?

The remainder of the article is structured as follows. Section 1 develops the theoretical framework underpinning the study and presents the conceptual foundations of the analytical dimensions employed in the research. Section 2 describes the research methodology, including the sampling procedure, research instrument, and analytical approach. Section 3 presents the empirical findings organised around the five analytical dimensions and the corresponding research questions. Section 4 discusses the findings in relation to the existing literature and the theoretical framework. Section 5 outlines the theoretical, policy, and practical implications of the study, while Section 6 addresses its limitations and identifies directions for future research. The final section summarises the principal conclusions.

1. Theoretical Framework of the Research

Prosumer energy should be understood not merely as a technical model of renewable energy generation but as a socio-institutional phenomenon that reconfigures relationships between the state, the market, local governments, and citizens (Campos and Marín-González 2020; Sciullo et al. 2022). Its significance extends beyond increasing the share of renewable energy sources in the energy mix, as it also involves a partial decentralisation of responsibility for managing the energy transition and a growing role for local and individual actors in energy-related decision-making (Hoicka et al. 2021; Neij et al. 2025). From this perspective, prosumers are not simply energy consumers who also generate electricity; they become active participants in the transition whose investment choices, consumption practices, and environmental attitudes contribute to shaping the local dimension of energy systems and policies (Milčiuvienė et al. 2019; Parra-Domínguez et al. 2023).

Contemporary approaches to the energy transition increasingly move beyond a predominantly technocentric perspective centred on infrastructure modernisation, technological efficiency, and the decarbonisation of the energy mix (Heffron 2022; Awolesi et al. 2024). Growing attention is instead being paid to the social legitimacy of transition processes, distributive and procedural justice, institutional capacity, citizen participation, and the ability of public institutions to mediate competing interests and values (Campos and Marín-González 2020; Wahlund and Palm 2022; Milčiuvienė et al. 2019). Accordingly, prosumer energy lies at the intersection of climate and energy policy, local development, citizen participation, social justice, environmental responsibility, and energy security.

This perspective is particularly relevant in rural areas. Rural municipalities often have considerable potential for renewable energy development owing to the availability of land, natural resources, and dispersed settlement structures (Standar et al. 2021; Kozera et al. 2024; Neij et al. 2025). At the same time, rural communities may face specific constraints, including lower household investment capacity, energy poverty, demographic ageing, infrastructural limitations, and conflicts between renewable energy development and the protection of landscape, spatial identity, and local interests. Prosumer energy may therefore function both as an instrument of local development and energy self-sufficiency and as a potential mechanism through which existing social and spatial inequalities are reproduced or intensified (Hanke et al. 2021; Tirado-Herrero 2023).

1.1. Identification and Structure of the Theoretical Dimensions

The theoretical framework adopted in this study was developed through a structured thematic synthesis of the literature on sustainable energy transitions, prosumer and citizen energy, energy justice, environmental responsibility, local conflicts associated with renewable energy development, and energy resilience. The analytical categories were identified on the basis of three principal criteria: their recurrent presence in the theoretical and empirical literature on decentralised energy transitions; their relevance to the social, institutional, and spatial characteristics of rural areas; and their suitability for operationalisation in a survey addressed to representatives of local government.

The review and thematic classification of the literature indicated that the conceptual foundations of the study operate at two interrelated levels. At the broader conceptual level, the sustainable energy transition and citizen and community energy provide the overarching framework for understanding prosumer energy as a socio-technical, institutional, and participatory phenomenon. Within this broader framework, five dimensions were identified for empirical analysis: (1) the contribution of prosumer energy to environmental and climate objectives, (2) energy justice, (3) environmental responsibility, (4) value conflicts, and (5) energy resilience.

This distinction is important because sustainable energy transition and citizen and community energy do not constitute additional empirical dimensions measured independently in the survey. Rather, they provide the conceptual foundation from which the five operational dimensions were derived. The same five dimensions subsequently informed the structure of the research instrument and the organisation of the empirical analysis. This two-level framework therefore ensures conceptual coherence between the theoretical foundations of the study and the operationalisation of the research questions.

1.2. Sustainable Energy Transition and Citizen Energy as the Overarching Conceptual Framework

The first overarching concept is that of the sustainable energy transition. A sustainable energy transition may be understood as a process of systemic change aimed at achieving climate and energy objectives while maintaining a balance between environmental, social, economic, and institutional considerations. From this perspective, the development of prosumer energy cannot be evaluated exclusively in terms of installed renewable-energy capacity or emission reductions. Its broader consequences for social inclusion, institutional arrangements, local development, and access to the benefits of the transition must also be considered (Awolesi et al. 2024).

Prosumer installations may contribute to reducing greenhouse gas emissions, increasing energy self-sufficiency, and strengthening environmental awareness among citizens (Heffron 2022). However, these outcomes do not in themselves guarantee that the transition is sustainable. A transition may produce environmental benefits while simultaneously reinforcing socioeconomic inequalities or excluding groups that lack sufficient financial, technical, or organisational capacity to participate. Sustainability therefore requires that environmental improvements are pursued without disproportionately shifting costs and risks onto vulnerable groups or disregarding local social and spatial conditions (Siciliano et al. 2021).

The second overarching concept is citizen and community energy. Walker and Devine-Wright (2008) emphasise that the social significance of renewable energy projects depends not only on where installations are located but also on who participates in them and how benefits and decision-making powers are distributed. From this perspective, prosumer energy should not be reduced to individual household investment. It may form part of a broader process of citizen empowerment, community participation, social capital formation, and the democratisation of energy systems (Campos and Marín-González 2020).

The development of citizen and community energy also depends strongly on institutional and organisational arrangements. Individual prosumerism, energy communities, and energy cooperatives represent different forms of participation in decentralised energy systems, each involving different models of ownership, governance, benefit-sharing, and collective action (Gajdzik et al. 2024). These organisational forms may be particularly relevant in rural areas, where collective arrangements may reduce individual investment barriers and enable a wider range of residents and local actors to participate in the energy transition. At the same time, without adequate informational, organisational, regulatory, and financial support, participation may remain

concentrated among households and organisations with greater economic and institutional resources (Wahlund and Palm 2022; Neij et al. 2025).

These considerations are also closely linked to prosumer behaviour. Decisions concerning the adoption and use of renewable-energy technologies are influenced not only by environmental values but also by economic incentives, expected savings, energy-security concerns, trust in public institutions, access to information, and the design of support mechanisms. Prosumer energy should therefore be analysed as the outcome of interactions between individual motivations, economic instruments, regulatory frameworks, and local institutional conditions rather than as a purely technological phenomenon.

1.3. Energy Justice

Energy justice provides the normative foundation for evaluating who benefits from the energy transition, who bears its costs, who is able to participate in decision-making processes, and whose circumstances and needs are recognised within energy policies. The literature traditionally distinguishes three principal dimensions of energy justice: distributive justice, procedural justice, and recognition justice (Jenkins et al. 2016; Heffron 2022).

Distributive justice concerns the allocation of the benefits, costs, risks, and opportunities associated with energy systems and transition processes. In the context of prosumer energy, this raises questions about whether access to renewable-energy investments and public support mechanisms is distributed equitably among different socioeconomic groups.

Procedural justice concerns the fairness and inclusiveness of decision-making processes. It requires meaningful opportunities for citizens and stakeholders to participate in decisions concerning energy policies, investments, infrastructure, and the allocation of public resources.

Recognition justice refers to the need to acknowledge differences in social position, vulnerability, needs, and capacity to participate in the transition. This dimension is particularly important for groups such as low-income households, older people, individuals affected by energy poverty, and residents whose housing conditions limit opportunities to become individual prosumers.

More recent developments in the energy-justice literature have also drawn attention to restorative justice as an additional dimension (Heffron & McCauley 2017; Hazrati & Heffron 2021). Restorative justice focuses on identifying, preventing, and remedying harms and inequalities produced or reinforced by energy

systems and transition processes. It encompasses questions of compensation, institutional correction, and mechanisms aimed at addressing the harm experienced by communities or social groups that bear disproportionate costs or are excluded from the benefits of the energy transition.

Although restorative justice was not operationalised as a separate empirical dimension in the questionnaire used in this study, its inclusion in the theoretical framework broadens the normative interpretation of energy justice. It highlights that a just energy transition requires not only fair distribution, meaningful participation, and recognition of vulnerable groups, but also mechanisms capable of addressing harms and inequalities that may arise during the transition.

Applying the energy-justice perspective to prosumer energy leads to an important analytical conclusion: prosumerism may simultaneously function as an instrument of a just transition and as a mechanism through which existing inequalities are reproduced. If the benefits of renewable-energy installations accrue mainly to households with sufficient financial capital, technical knowledge, property ownership, and favourable locational conditions, the transition may deepen the distinction between those who can actively participate in energy transformation and those who remain primarily passive consumers of its outcomes.

Consequently, the evaluation of prosumer energy requires consideration not only of its environmental effectiveness but also of its social accessibility. The ability of local communities to participate meaningfully in energy-related decision-making processes, together with the recognition and protection of vulnerable groups, constitutes an important normative condition of sustainable local energy governance.

1.4. Environmental Responsibility

Environmental responsibility represents another important dimension of the relationship between prosumer energy and the sustainable energy transition. The development of prosumer energy may strengthen individuals' awareness of the environmental consequences of energy consumption by directly connecting everyday consumption decisions with local energy generation (Campos and Marín-González 2020; Milčiuvienė et al. 2019; Parra-Domínguez et al. 2023).

From this perspective, the prosumer becomes an actor within practical environmental ethics. Decisions concerning energy generation and consumption have not only technological and economic consequences but also normative implications connected with the common good, greenhouse-gas reduction, stewardship of natural resources, and responsibility towards present and future generations.

From the perspective of environmental ethics, prosumer energy also changes the relationship between individuals and the natural environment by making the environmental consequences of everyday energy choices more visible. Energy production and consumption cease to appear as distant technical processes and become practices through which individuals and communities express particular attitudes towards natural resources, climate protection, and intergenerational responsibility. Prosumerism may therefore be interpreted not only as participation in an energy market but also as a practical form of environmental agency.

However, environmental responsibility should not be conceptualised solely as an individual obligation. Excessive emphasis on individual responsibility may obscure the institutional and structural conditions that determine whether environmentally responsible choices are realistically available. Public authorities, including municipalities, therefore retain an important role in creating favourable institutional conditions, providing information and environmental education, supporting access to renewable-energy technologies, and preventing vulnerable groups from being excluded from the transition process (Neij et al. 2025).

The relationship between prosumer energy and environmental responsibility is consequently reciprocal. Prosumerism may strengthen environmental awareness and responsibility among residents, while public institutions may shape the social and institutional environment within which environmentally responsible energy choices become possible.

1.5. Value Conflicts

The energy transition is not an axiologically neutral process. It involves choices between objectives and values that may complement one another but may also come into conflict (Walker and Devine-Wright 2008; Eichenauer and Gailing 2022). At the local level, such tensions may arise between climate protection, landscape conservation, economic development, residents' property interests, energy affordability, energy security, and the preservation of spatial order.

These conflicts may be particularly visible in rural areas, where renewable-energy infrastructure is often located in landscapes that simultaneously possess ecological, cultural, aesthetic, agricultural, and identity-related significance. Renewable-energy installations may therefore be perceived both as manifestations of modernisation and climate responsibility and as interventions that alter traditional landscapes and local senses of place (Devine-Wright 2009).

The existence of such conflicts means that public support for renewable-energy development cannot be explained solely by general attitudes towards climate policy. Individuals and local authorities may support decarbonisation while simultaneously opposing particular projects because of their location, scale, perceived distribution of benefits, or consequences for landscape and community interests.

For this reason, examining the perceptions of representatives of rural municipalities requires consideration not only of whether they support prosumer and renewable energy in principle, but also of how competing environmental, social, economic, and spatial values are prioritised when they cannot be fully reconciled.

1.6. Energy Resilience

Energy resilience refers to the capacity of households, communities, institutions, and energy systems to withstand, adapt to, and recover from disruptions affecting energy availability, affordability, and security. The importance of this dimension has increased in the context of energy-price volatility, geopolitical instability, supply disruptions, and broader uncertainty affecting contemporary energy systems.

Distributed renewable-energy sources may enhance local resilience by reducing dependence on centralised supply structures, increasing energy self-sufficiency, diversifying sources of energy, and strengthening the capacity of households and communities to cope with external shocks (Hoicka et al. 2021; Neij et al. 2025).

Prosumer energy may therefore be understood not only as an instrument of decarbonisation but also as a potential component of local energy-security strategies. Its resilience benefits, however, depend on the scale and inclusiveness of participation. If access to prosumer installations is restricted primarily to households with sufficient investment resources, the resilience generated by decentralised energy systems may remain unevenly distributed (Hanke et al. 2021).

This issue is particularly relevant in rural areas, where dispersed settlement patterns, infrastructural constraints, higher transport dependence, and differences in household income may influence both exposure to energy-related shocks and the capacity to invest in alternative energy sources. Energy resilience is therefore closely related to energy justice: the capacity of decentralised energy to strengthen community resilience depends partly on whether its benefits extend beyond relatively affluent individual prosumers.

1.7. Integration of the Analytical Framework

The dimensions incorporated into the theoretical framework are closely interrelated rather than entirely independent. Energy justice may influence the social legitimacy and accessibility of prosumer energy and, consequently, its capacity to strengthen local energy resilience. Environmental responsibility may affect individual and collective willingness to participate in renewable-energy initiatives, while value conflicts may influence public acceptance and the implementation of particular energy investments.

At the same time, the broader concepts of sustainable energy transition and citizen and community energy provide the conceptual setting within which these relationships can be interpreted. They connect the five empirical dimensions by locating prosumer energy within a wider process of technological change, institutional transformation, citizen participation, and redistribution of responsibilities and benefits.

The framework adopted in this study therefore conceptualises prosumer energy as a multidimensional socio-technical and institutional phenomenon. Its role in the sustainable energy transition cannot be assessed solely through its contribution to renewable-energy production or greenhouse-gas reduction. It must also be considered in relation to social accessibility, justice, environmental responsibility, competing public values, and the resilience of local communities.

From this perspective, the views of representatives of rural municipalities are analytically important because local governments operate at the intersection of national energy policy, local development, spatial planning, public-service provision, and community interests. Their perceptions provide insight into whether prosumer energy is understood at the local institutional level as a broadly accessible instrument of the sustainable energy transition or primarily as a solution whose benefits remain concentrated among selected social groups.

2. Methodology

The study employed a quantitative research approach using a survey. This approach was selected in accordance with the nature of the research problem and the adopted theoretical framework. The purpose of the study was not to determine the actual level of prosumer energy development in individual municipalities, but rather to identify how its role in the energy transition is perceived by representatives of local authorities involved in shaping the institutional and organisational conditions for the energy transition at the local level. Survey research is widely used to investigate respondents' attitudes, opinions, and evaluations concerning

social phenomena and public policies (Babbie 2020; Creswell & Creswell 2018). It is also commonly applied in research on public administration and the implementation of development and environmental policies (Campos & Marín-González 2020; Rakowska & Ozimek 2021).

The study population consisted of all rural municipalities operating in Poland (N = 1,459). The initial research sample comprised 730 municipalities selected using simple random sampling from the complete population of rural municipalities. This sampling procedure was adopted to minimise systematic selection bias and to ensure that each unit in the target population had an equal probability of inclusion in the study.

The target sample size was determined by considering the size of the study population and the need to obtain estimates with an acceptable level of sampling error. For a finite population of 1,459 rural municipalities, a sample substantially exceeding the conventional minimum required for a 95% confidence level and a maximum margin of error of approximately 5% was selected in order to account for anticipated non-response and to preserve sufficient analytical power after data collection. The final number of valid responses (n = 518) represented 35.5% of the entire population of rural municipalities in Poland, providing a broad empirical basis for identifying general patterns at the national level. The unit of analysis was the rural municipality, while respondents were representatives of municipal executive authorities or individuals authorised to respond on behalf of the local government unit.

The study was conducted between November 2025 and February 2026. Questionnaires were distributed in November 2025, and data collection was completed on 28 February 2026. To maximise the response rate, a mixed-mode distribution strategy was adopted. The questionnaire was sent electronically to 623 municipalities for which official e-mail addresses of executive authorities were available on municipal websites, while the questionnaires were sent by post to the remaining municipalities. Mixed-mode survey distribution is commonly recommended in research involving public institutions because it may reduce coverage limitations and contribute to higher response rates (Dillman et al. 2014).

A total of 518 valid completed questionnaires were returned, corresponding to a response rate of 71.0% relative to the 730 municipalities included in the initial sample. Consequently, the final dataset covered 35.5% of all rural municipalities operating in Poland. This response rate is comparatively high for organisational and public-administration surveys, although the possibility of non-response bias cannot be excluded (Dillman et al. 2014).

Respondents represented all voivodeships in Poland. The highest numbers of responses were obtained from the Małopolskie (85 municipalities), Mazowieckie (71 municipalities), and Dolnośląskie (64 municipalities) voivodeships, while the lowest numbers were recorded in the Łódzkie (9 municipalities), Zachodniopomorskie (9 municipalities), Pomorskie (11 municipalities), and Lubuskie (12 municipalities) voivodeships. Although the final sample provided nationwide territorial coverage, it was not proportionally stratified by voivodeship, and the number of participating municipalities varied across regions. Accordingly, the study was designed to identify general patterns in the perceptions of representatives of rural municipalities at the national level rather than to support direct interregional comparisons.

The research instrument was developed on the basis of the theoretical framework adopted in the study and a structured review of the literature on energy transition, prosumer energy, energy justice, environmental responsibility, value conflicts, and the energy resilience of local communities (Sovacool & Dworkin 2015; Jenkins et al. 2016; Bouzarovski & Simcock 2017).

The questionnaire-development process involved translating the theoretical concepts identified in the literature into empirically observable dimensions and survey items. Particular attention was paid to those themes that recurred across previous theoretical and empirical studies and that could be meaningfully assessed by representatives of rural municipalities. The formulation of individual questions was therefore guided by both the conceptual framework and earlier research on citizen participation in energy transition, distributive and procedural aspects of energy justice, environmental attitudes, local value conflicts, and energy resilience.

The questionnaire was also informed by the authors' previous research experience concerning local-government involvement in environmental, spatial, and energy-related policies. This prior research helped to adapt the theoretical constructs to the institutional realities of rural municipalities and to formulate questions in a manner relevant to respondents performing public-administration functions.

Consistent with the two-level theoretical framework presented in Section 1, the questionnaire operationalised five empirical dimensions derived from the broader concepts of sustainable energy transition and citizen and community energy. The first section addressed the significance of prosumer energy for achieving the objectives of the sustainable energy transition. The second focused on issues related to energy justice, including the accessibility of benefits arising from the energy transition and the identification of groups particularly vulnerable to energy exclusion. The third section examined residents' environmental responsibility and the role of local government in fostering pro-environmental attitudes. The fourth addressed

value conflicts arising in the course of the energy transition, while the fifth concerned the energy resilience of rural areas and the importance of prosumer energy in strengthening the energy security of local communities. Thus, the five sections of the questionnaire corresponded directly to the five operational dimensions of the empirical analysis, whereas sustainable energy transition and citizen and community energy served as overarching conceptual categories rather than separate survey dimensions.

The questionnaire consisted predominantly of closed-ended questions and statements assessed using a five-point Likert scale. This scale enabled the assessment of respondents' degree of agreement with individual statements and facilitated comparisons across respondents and thematic dimensions (Likert 1932; Boone & Boone 2012; Joshi et al. 2015). The use of a five-point scale also entails the possibility of central tendency bias, whereby respondents may disproportionately select the middle category when they are uncertain, reluctant to express a definitive opinion, or perceive the issue as complex or sensitive. This possibility was taken into account when interpreting relatively high proportions of neutral or "difficult to say" responses in selected items. Such responses were therefore interpreted cautiously and not treated automatically as evidence of indifference or absence of opinion.



Figure 1. Methodological algorithm of the study. Source: Author's own elaboration; visual layout and readability enhanced by the SEeB Editorial Team with the assistance of AI.

The empirical material was analysed using descriptive statistical methods. Frequencies and percentage distributions were calculated for each response category to identify the dominant patterns in respondents' assessments. The use of descriptive analysis was consistent with the exploratory character of the study, which represents the first stage of a broader research programme on the role of prosumer energy in the sustainable energy transition of rural areas. At this stage, the analysis focused on identifying and systematising the principal patterns in the perceptions of representatives of rural municipalities rather than on testing relationships between variables or developing explanatory or predictive models. The interpretation of the findings was grounded in the theoretical framework encompassing environmental and climate objectives, energy justice, environmental responsibility, value conflicts, and energy resilience. Accordingly, inferential and multivariate statistical techniques, which would address relationships between variables and explanatory mechanisms rather than the descriptive research questions formulated in this study, were deliberately reserved for the subsequent analytical stage of the research programme.

It should be emphasised that the findings reflect respondents' declared assessments and therefore relate to the perceived role of prosumer energy as evaluated by representatives of local authorities. They should not be interpreted as direct measures of the actual level of prosumer energy development in individual municipalities. Furthermore, although the final sample was large and provided nationwide territorial coverage, it was not proportionally stratified by voivodeship. Consequently, the findings are intended to identify general patterns in the perceptions of representatives of rural municipalities rather than to provide a basis for detailed interregional comparisons.

3. Results

3.1. Prosumer Energy and Sustainable Energy Transition Objectives

The first part of the study examined how representatives of rural municipalities perceived prosumer energy in the context of the sustainable energy transition. Respondents were asked to assess the statement that prosumer energy constitutes an important component of the sustainable energy transition in rural areas.

The results indicate a high level of agreement with the statement under consideration. Of the 518 respondents, 305 (58.9%) selected "rather agree", while 117 (22.6%) selected "strongly agree". In total, 81.5% of the surveyed municipalities expressed a positive assessment. Negative responses accounted for 4.6% of all answers, whereas 13.9% of respondents selected the option "difficult to say" (Table 1).

The distribution of responses demonstrates a clear predominance of positive over negative evaluations. More than four-fifths of respondents regarded prosumer energy as an important component of the sustainable energy transition in rural areas, while only a small proportion expressed the opposite opinion. These findings indicate that representatives of rural municipalities predominantly perceive prosumer energy as an important component of the sustainable energy transition.

Particular attention should also be paid to the proportion of non-committal responses. The option "difficult to say" was selected by 13.9% of respondents, indicating that some participants did not adopt a clear position regarding the significance of prosumer energy for the energy transition of rural areas. As noted in the methodological section, responses in the middle category should be interpreted cautiously, as they may reflect uncertainty, limited direct experience with prosumer-energy development, or a reluctance to adopt an unequivocal position rather than simple indifference towards the issue.

Table 1. Assessment of the Importance of Prosumer Energy for the Sustainable Energy Transition of Rural Areas (N = 518)

This table presents respondents' assessments of the importance of prosumer energy for the sustainable energy transition of rural areas. Most respondents agreed or strongly agreed (81.5%), while 4.6% expressed a negative assessment.

Response	Number of respondents	% of respondents
Strongly disagree	1	0.2
Rather disagree	23	4.4
Difficult to say	72	13.9
Rather agree	305	58.9
Strongly agree	117	22.6
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

In the next question, respondents were asked to assess the importance of prosumer energy for achieving selected objectives associated with the sustainable energy transition. The distribution of responses is presented in Table 2.

Table 2. Assessment of the Importance of Prosumer Energy for Achieving Selected Sustainable Energy Transition Objectives (N = 518)

This table compares assessments of six objectives that prosumer energy may support, using a five-point scale from 1 to 5. Environmental protection and greenhouse-gas reduction received the highest ratings, whereas reducing energy poverty and promoting pro-environmental attitudes received more differentiated assessments.

Objective	1	2	3	4	5
Environmental protection	0	0	14	379	125
Reduction of greenhouse gas emissions	0	11	23	196	288
Energy security	24	41	76	218	159
Reduction of energy poverty	82	63	91	167	115
Local community development	112	76	89	169	72
Promotion of pro-environmental attitudes	95	79	115	118	111

Source: Author's own elaboration based on survey results.

The results reveal considerable variation in respondents' assessments of the different functions of prosumer energy. Its role in reducing greenhouse gas emissions received the highest evaluation. Ratings of 4 or 5 were assigned by 484 respondents (93.4%), while more than half of the participants (55.6%) awarded the highest possible score. The importance of prosumer energy for environmental protection was also assessed very positively, with ratings of 4 and 5 accounting for 97.3% of all responses.

A relatively high level of importance was also attributed to the contribution of prosumer energy to energy security. Ratings of 4 or 5 were given by 377 respondents (72.8%), whereas negative ratings (1 or 2) accounted for 12.5% of all responses.

Opinions concerning social objectives were more diverse. In the case of reducing energy poverty, positive ratings (4 and 5) accounted for 54.4% of all responses, while low ratings accounted for a relatively high 27.9%. Even lower evaluations were recorded for the contribution of prosumer energy to local community development and the promotion of pro-environmental attitudes. In the former case, positive responses represented 46.5% of all indications, while in the latter they accounted for 44.2%.

Overall, the findings reveal a clear hierarchy in the perceived functions of prosumer energy. Representatives of rural municipalities attribute the greatest importance to its environmental and climate-related functions, particularly environmental protection and greenhouse-gas reduction, followed by its contribution to energy security. By contrast, assessments of its role in addressing energy poverty, supporting local community development, and promoting pro-environmental attitudes are more differentiated. This pattern suggests that, at this exploratory stage of the analysis, prosumer energy is perceived primarily through its environmental, climate, and energy-security functions rather than through its broader social effects.

3.2. Energy Justice in the Development of Prosumer Energy

An important element of the study concerned the assessment of the potential social consequences associated with the development of prosumer energy. Respondents were asked whether the development of this sector could lead to unequal access to the benefits arising from the energy transition. The distribution of responses is presented in Table 3.

Table 3. Assessment of the Risk of Unequal Access to the Benefits of the Energy Transition (N = 518)
This table shows whether respondents perceive a risk of unequal access to the benefits of the energy transition. Responses were divided, with 38.4% recognising such a risk, 33.6% rejecting it, and 28.0% selecting "difficult to say".

Response	Number of respondents	% of respondents
Definitely yes	84	16.2
Rather yes	115	22.2
Difficult to say	145	28.0
Rather no	117	22.6
Definitely no	57	11.0
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The results reveal considerable variation in respondents' views on this issue. In total, 199 respondents (38.4%) believed that the development of prosumer energy could lead to unequal access to the benefits of the energy transition. Of these, 16.2% selected "definitely yes" and 22.2% selected "rather yes." An opposite view was expressed by 174 respondents (33.6%), while 145 individuals (28.0%) chose the option "difficult to say" (Table 3).

The distribution of responses does not indicate a clear predominance of any particular viewpoint. The difference between positive and negative responses amounted to only 4.8 percentage points. Furthermore, more than one-quarter of respondents did not express a definitive opinion. The relatively high proportion of "difficult to say" responses (28.0%) may also indicate uncertainty surrounding the distributive consequences of prosumer-energy development, suggesting that the implications of prosumerism for energy justice are less unequivocally perceived than its environmental and climate-related benefits.

These findings suggest that the assessment of the social consequences of prosumer energy development remains ambiguous among representatives of rural municipalities. While some respondents recognise the possibility of inequalities in access to the benefits of the energy transition, a comparable group does not share

this view. The responses therefore indicate substantial variation in assessments of the social impacts of prosumer energy development.

In the subsequent question, respondents were asked to identify social groups that may be particularly vulnerable to exclusion from the benefits associated with the development of prosumer energy. Participants were allowed to select up to three responses. The results are presented in Table 4.

Table 4. Groups Most Vulnerable to Exclusion from the Benefits of Prosumer Energy

This table identifies social groups considered vulnerable to exclusion from the benefits of prosumer energy. Residents of multi-family buildings, low-income households, and older people were identified most frequently; respondents could select more than one answer.

Group	Number of respondents	% of respondents*
Residents of multi-family buildings	512	98.8
Low-income households	496	95.8
Older people	431	83.2
I do not perceive such a risk	118	22.8
Small farms	115	22.2
Owners of properties requiring modernisation	74	14.3
Other	0	0.0

* Multiple responses were permitted; therefore, percentages do not sum to 100%.

Source: Author's own elaboration based on survey results.

The responses indicate a high degree of consensus regarding groups particularly vulnerable to exclusion from the benefits of prosumer energy development. The most frequently identified groups were residents of multi-family buildings (98.8%) and low-income households (95.8%). A high proportion of respondents also identified older people (83.2%) as being at risk.

Small farms (22.2%) and owners of properties requiring modernisation (14.3%) were identified considerably less frequently as groups at risk of exclusion. At the same time, 22.8% of respondents declared that they did not perceive any risk of exclusion affecting particular social groups.

The distribution of responses suggests that respondents primarily associate the risk of exclusion with groups whose participation in prosumer energy development may be constrained by housing conditions, financial limitations, or age-related factors. Particularly noteworthy is the near-universal identification of residents of multi-family buildings and low-income households as groups at risk of exclusion.

Respondents were also asked how public funds intended to support the energy transition should be allocated under conditions of limited financial resources. The results are presented in Table 5.

Table 5. Preferred Directions of Public Support under Conditions of Limited Financial Resources (N = 518)
This table presents respondents' preferred priorities for public support when financial resources are limited. Households threatened by energy poverty were selected most frequently, followed by older people and support available to all residents on equal terms.

Response	Number of respondents	% of respondents
Households threatened by energy poverty	174	33.6
Older people	112	21.6
All residents on equal terms	79	15.3
Farms	71	13.7
Residents with the greatest investment potential	64	12.4
Difficult to say	18	3.5
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The results reveal diverse preferences regarding the allocation of public support. The most frequently selected option was to direct resources towards households at risk of energy poverty, chosen by 174 respondents (33.6%). Older people constituted the second most frequently selected group (21.6%).

Less support was expressed for an approach based on equal access to public support for all residents (15.3%). Even fewer respondents prioritised farms (13.7%) or residents with the greatest investment potential (12.4%). The option "difficult to say" was selected by 3.5% of respondents.

Overall, the findings indicate a preference for a needs-oriented rather than a purely universal or investment-capacity-based approach to the allocation of public support. Households threatened by energy poverty and older people were jointly prioritised by 55.2% of respondents, whereas substantially fewer respondents favoured equal access for all residents or prioritising those with the greatest investment potential. From an energy-justice perspective, this distribution suggests that representatives of rural municipalities tend to recognise vulnerability as an important criterion for allocating limited public resources.

3.3. Environmental Responsibility in the Context of Prosumer Energy Development

The next part of the study examined perceptions of the relationship between the development of prosumer energy and residents' environmental responsibility, as well as assessments of the role of rural municipalities in promoting pro-environmental attitudes associated with the energy transition. Respondents were asked to evaluate the statement that the development of prosumer energy contributes to an increase in

residents' responsibility towards the natural environment. The distribution of responses is presented in Table 6.

Table 6. Assessment of the Impact of Prosumer Energy on Increasing Residents' Environmental Responsibility (N = 518)

This table presents assessments of whether prosumer energy increases residents' environmental responsibility. A substantial majority of respondents agreed or strongly agreed (74.9%), while 4.4% disagreed.

Response	Number of respondents	% of respondents
Strongly disagree	14	2.7
Rather disagree	9	1.7
Difficult to say	107	20.7
Rather agree	205	39.6
Strongly agree	183	35.3
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The distribution of responses reveals a clear predominance of positive evaluations. In total, 388 respondents (74.9%) agreed that the development of prosumer energy contributes to increasing residents' responsibility towards the natural environment, including 35.3% who selected "strongly agree" and 39.6% who selected "rather agree." The opposite opinion was expressed by 23 respondents (4.4%), while 107 respondents (20.7%) selected the option "difficult to say" (Table 6).

These findings indicate that representatives of rural municipalities overwhelmingly perceive a relationship between the development of prosumer energy and increased environmental responsibility among residents. At the same time, the proportion of negative responses was exceptionally low, accounting for less than 5% of all indications. The results therefore indicate a high level of agreement with the view that the development of prosumer energy may contribute to fostering more environmentally responsible attitudes.

In the subsequent question, respondents were asked to assess a statement concerning the active role of rural municipalities in shaping residents' pro-environmental attitudes related to the energy transition. The results are presented in Table 7.

Table 7. Assessment of the Role of Rural Municipalities in Promoting Residents' Pro-Environmental Attitudes Related to the Energy Transition (N = 518)

This table shows assessments of the role of rural municipalities in promoting residents' pro-environmental attitudes related to the energy transition. The largest group selected "difficult to say" (36.9%), indicating no clear consensus.

Response	Number of respondents	% of respondents
Strongly disagree	86	16.6
Rather disagree	82	15.8
Difficult to say	191	36.9
Rather agree	97	18.7
Strongly agree	62	12.0
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The results indicate considerable diversity of opinion among respondents. In total, 159 respondents (30.7%) agreed that rural municipalities should play an active role in shaping residents' pro-environmental attitudes, including 18.7% who selected "rather agree" and 12.0% who selected "strongly agree." An opposing view was expressed by 168 respondents (32.4%), while 191 individuals (36.9%) selected "difficult to say" (Table 7).

In contrast to the relatively strong agreement concerning the relationship between prosumer energy and residents' environmental responsibility, no comparable consensus emerged regarding the active role of municipalities in shaping pro-environmental attitudes. Positive (30.7%) and negative (32.4%) assessments were almost evenly distributed, while the largest proportion of respondents selected "difficult to say" (36.9%). This pattern suggests considerable uncertainty regarding the extent to which responsibility for fostering pro-environmental attitudes should be attributed to local government and suggests that the perceived institutional role of municipalities in this area is less clearly defined than the perceived environmental effects of prosumerism itself.

3.4. Value Conflicts in the Energy Transition Process

The next part of the study examined perceptions of potential value conflicts arising during the energy transition in rural areas. Respondents were asked to indicate which objective should take precedence in a situation where the development of renewable energy sources contributes to reducing greenhouse gas emissions but simultaneously results in significant changes to the rural landscape. The distribution of responses is presented in Table 8.

Table 8. Preferences Regarding Climate Protection and Landscape Protection in the Development of Renewable Energy Sources (N = 518)

This table presents preferences between climate protection and landscape protection in renewable-energy development. Nearly half of respondents considered both objectives equally important, while almost one-third selected "difficult to say".

Response	Number of respondents	% of respondents
Climate protection	72	13.9
Landscape protection	34	6.6
Both objectives are equally important	248	47.9
Difficult to say	164	31.7
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The results indicate that the most frequently selected response was the view that climate protection and landscape protection are of equal importance. This option was chosen by 248 respondents (47.9%). Considerably fewer respondents favoured giving unequivocal priority either to climate protection (13.9%) or to landscape protection (6.6%).

A further noteworthy finding is the relatively high proportion of respondents who did not express a clear opinion on this issue. The option "difficult to say" was selected by 164 respondents (31.7%).

The distribution of responses indicates that the largest group of respondents regarded climate protection and landscape protection as equally important (47.9%). At the same time, the high proportion of "difficult to say" responses (31.7%) indicates substantial uncertainty when respondents are confronted with an explicit conflict between environmental objectives. Only a minority unequivocally prioritised either climate protection or landscape protection, suggesting limited support for resolving such conflicts through the categorical primacy of a single value.

In the following question, respondents were asked to identify the objective that should receive the highest priority within local energy policy. The results are presented in Table 9.

Table 9. Priorities of Local Energy Policy According to Representatives of Rural Municipalities (N = 518)

This table presents the local energy-policy priorities indicated by representatives of rural municipalities. Reducing energy costs and strengthening energy security were selected more frequently than environmental protection or community engagement.

Response	Number of respondents	% of respondents
Reducing energy costs	193	37.3
Energy security	148	28.6

Response	Number of respondents	% of respondents
Reducing energy poverty	92	17.8
Environmental protection	53	10.2
Community mobilisation and engagement	32	6.2
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The findings reveal considerable variation in preferences regarding the priorities of local energy policy. The most frequently selected objective was reducing energy costs, which was identified as the highest priority by 193 respondents (37.3%). The second most frequently selected objective was energy security, indicated by 148 respondents (28.6%).

Reducing energy poverty was selected as the highest priority by 17.8% of respondents. Environmental protection (10.2%) and community mobilisation and engagement (6.2%) were selected even less frequently.

Taken together, 65.9% of respondents identified either reducing energy costs or strengthening energy security as the highest priority of local energy policy. This distribution reveals a clear predominance of immediate economic and energy-security concerns over explicitly environmental and participatory objectives. Importantly, this pattern contrasts with the very high assessments of the environmental and climate-related functions of prosumer energy reported in Section 3.1. Respondents therefore appear to distinguish between the perceived benefits of prosumer energy and the priorities that should guide local energy policy.

3.5. Energy Resilience of Rural Areas

The final part of the study concerned the assessment of the significance of prosumer energy for enhancing the energy resilience of rural areas and its place within the development policies of rural municipalities. Respondents were asked to evaluate the impact of prosumer energy on municipalities' capacity to respond to energy crises and rising energy prices. The distribution of responses is presented in Table 10.

Table 10. Assessment of the Impact of Prosumer Energy on the Resilience of Rural Municipalities to Energy Crises and Rising Energy Prices (N = 518)

This table shows assessments of the contribution of prosumer energy to the resilience of rural municipalities during energy crises and rising energy prices. Most respondents assessed this contribution as large or very large (79.7%).

Response	Number of respondents	% of respondents
To a very small extent	17	3.3
To a small extent	25	4.8

Response	Number of respondents	% of respondents
Difficult to say	63	12.2
To a large extent	287	55.4
To a very large extent	126	24.3
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The results indicate a highly positive assessment of the potential contribution of prosumer energy to the energy resilience of rural areas. In total, 413 respondents (79.7%) considered that prosumer energy could strengthen municipalities' capacity to respond to energy crises and rising energy prices to a large or very large extent. By contrast, only 8.1% assessed this contribution as small or very small, while 12.2% selected "difficult to say."

This distribution indicates that energy resilience constitutes one of the most clearly recognised functions of prosumer energy among representatives of rural municipalities, alongside its environmental and climate-related benefits.

In the subsequent question, respondents were asked to assess a statement concerning the place of prosumer energy within the development policy of rural municipalities. The distribution of responses is presented in Table 11.

Table 11. Assessment of the Importance of Prosumer Energy as a Development Policy Priority for Rural Municipalities in Poland (N = 518)

This table presents assessments of whether prosumer energy should be treated as a development-policy priority for rural municipalities in Poland. Most respondents agreed or strongly agreed (79.3%), while 6.8% disagreed.

Response	Number of respondents	% of respondents
Strongly disagree	0	0.0
Rather disagree	35	6.8
Difficult to say	72	13.9
Rather agree	202	39.0
Strongly agree	209	40.3
Total	**518**	**100.0**

Source: Author's own elaboration based on survey results.

The results indicate a high level of support for incorporating prosumer energy into the development policies of rural municipalities. In total, 411 respondents (79.3%) agreed that the development of prosumer energy should constitute one of the priorities of development policy in rural municipalities in Poland. Among them, 39.0% selected “rather agree”, while 40.3% selected “strongly agree.”

Negative responses accounted for 6.8% of all indications, and notably, none of the respondents selected the option “strongly disagree.” At the same time, 72 respondents (13.9%) chose the response “difficult to say” (Table 11).

The distribution of responses reveals a clear predominance of positive over negative evaluations. Nearly four-fifths of respondents regarded the development of prosumer energy as one of the priorities of rural municipal development policy, whereas the proportion of negative assessments remained relatively low.

These findings indicate strong support for including prosumer energy among the development priorities of rural municipalities.

3.6. Synthesis of the Findings in Relation to the Research Questions

The descriptive analysis identified five principal patterns corresponding to the research questions and analytical dimensions adopted in the study.

With regard to RQ1, the findings indicate that representatives of rural municipalities predominantly perceive prosumer energy as an important component of the sustainable energy transition. Its contribution is most strongly associated with environmental protection, greenhouse-gas reduction, and energy security, whereas assessments of its broader social functions are more differentiated.

Regarding RQ2, the findings reveal a more ambiguous picture of energy justice. Although some respondents recognised the possibility of unequal access to the benefits of prosumer-energy development and specific groups were frequently identified as vulnerable to exclusion, opinions concerning the overall risk of inequality were divided. At the same time, preferences regarding the allocation of limited public resources indicate relatively strong support for prioritising groups perceived as vulnerable, particularly households threatened by energy poverty and older people.

In relation to RQ3, respondents largely perceived prosumer energy as contributing to greater environmental responsibility among residents. However, no comparable consensus emerged regarding the

active role of rural municipalities in shaping pro-environmental attitudes, indicating greater uncertainty about the institutional allocation of responsibility for environmental engagement.

With regard to RQ4, the findings suggest a preference for treating competing objectives as equally important rather than unequivocally prioritising a single value. Nevertheless, when respondents were asked to identify the highest priority of local energy policy, economic and energy-security objectives clearly predominated over explicitly environmental and participatory goals.

Finally, in relation to RQ5, prosumer energy was widely perceived as a factor capable of strengthening the energy resilience of rural communities. A substantial majority of respondents also supported its inclusion among the priorities of rural municipal development policy, indicating that prosumer energy is perceived not only in environmental terms but also as an element of local energy security and resilience.

Taken together, the findings indicate that representatives of rural municipalities perceive prosumer energy as a multidimensional component of the sustainable energy transition. Its environmental, climate-related, and energy-resilience functions are assessed most consistently, whereas its implications for energy justice, institutional responsibility, and competing local values generate more differentiated and uncertain assessments. These patterns provide the empirical basis for the discussion of the findings in relation to the theoretical framework and existing literature presented in the following section.

4. Discussion

4.1. Prosumer Energy as an Instrument of the Sustainable Energy Transition in Rural Areas

The findings provide a broadly affirmative answer to RQ1, indicating that representatives of rural municipalities perceive prosumer energy as an important component of the sustainable energy transition. Importantly, however, this positive assessment is not uniform across the different functions attributed to prosumerism. Its environmental and climate-related contributions, particularly environmental protection and greenhouse-gas reduction, are perceived as considerably more important than its broader social functions. This differentiation suggests that the local-government perspective on prosumer energy remains predominantly oriented towards its environmental, technological, and energy-security benefits.

This interpretation is consistent with studies conceptualising prosumer energy as an important mechanism of energy-system decentralisation and increased citizen participation in renewable-energy generation (Milčiuvienė et al. 2019; Hoicka et al. 2021; Parra-Domínguez et al. 2023). It also corresponds

with broader approaches to the sustainable energy transition that extend beyond decarbonisation to encompass energy security, institutional adaptation, and the resilience of communities to energy-related disruptions (Heffron 2022; Awolesi et al. 2024; Neij et al. 2025). The present study contributes to this literature by demonstrating that these functions are also widely recognised by local-government representatives in rural areas, a group whose perspective has received comparatively less attention in previous research.

A particularly important finding is the asymmetry between the environmental and energy-related functions attributed to prosumer energy and its perceived social functions. While respondents strongly recognised its contribution to environmental protection, emission reduction, and energy security, they attributed comparatively less importance to its role in local community development and the promotion of pro-environmental attitudes. This finding is theoretically significant because the literature increasingly conceptualises prosumerism not merely as decentralised energy generation but as part of a broader process of citizen energy, participation, and the democratisation of energy systems (Walker & Devine-Wright 2008; Wolsink 2012; Campos & Marín-González 2020). Recent evidence from Poland further indicates that household intentions to adopt renewable-energy technologies are shaped by perceived usefulness, ease of use, and social factors, confirming that participation in the energy transition depends on behavioural and social considerations as well as technological availability (Siuda & Gręboszk-Krawczyk 2025). The results of the present study reveal a potential gap between this broader normative and theoretical understanding of prosumerism and the way in which its role is perceived at the local-government level. In this sense, the contribution of prosumer energy to technological and environmental transformation appears to be more firmly recognised than its potential contribution to social and civic transformation.

4.2. Prosumer Energy and Energy Justice

The findings relating to RQ2 present a more complex and less clear-cut picture than those concerning the environmental and climate-related benefits of prosumer energy. Respondents' assessments of whether the development of prosumer energy may lead to unequal access to the benefits of the energy transition were divided, with a substantial proportion expressing uncertainty. This ambiguity is analytically important: while the environmental benefits of prosumerism appear to be widely recognised, its distributive consequences are perceived much less uniformly. The findings therefore suggest that positive assessments of prosumer energy do not necessarily imply an equally positive assessment of the fairness with which its benefits are distributed.

The identification of groups perceived as particularly vulnerable to exclusion provides further insight into the justice implications of prosumer-energy development. Respondents most frequently identified residents of multi-family buildings, low-income households, and older people as groups facing particular barriers to participation. These findings point to the perceived importance of several intersecting constraints, including financial capacity, housing conditions, age-related vulnerabilities, and unequal opportunities to invest in individual renewable-energy installations. In this respect, the results indicate that representatives of rural municipalities recognise that formal access to the energy transition does not necessarily translate into an equal practical capacity to participate in, and benefit from, prosumer energy.

This interpretation is consistent with the energy-justice literature, which demonstrates that the benefits, costs, and opportunities associated with energy transitions may be unevenly distributed and may reproduce or reinforce pre-existing socioeconomic inequalities (Sovacool and Dworkin 2015; Jenkins et al. 2016; Hanke et al. 2021; Tirado-Herrero 2023; Lacey-Barnacle 2024). The present findings extend this perspective by showing that such distributive concerns are also recognised, albeit not uniformly, by representatives of rural municipalities. This is particularly relevant because decentralised renewable-energy development may simultaneously expand opportunities for citizen participation and create new forms of differentiation between those who possess the financial, housing, and organisational capacity to become active participants in the transition and those whose opportunities to participate remain constrained.

Viewed through the multidimensional framework of energy justice, the findings relate most directly to distributive and recognition justice. The differentiated capacity of residents to access the benefits of prosumer energy raises a distributive question concerning how the benefits, costs, and opportunities of the transition are allocated. At the same time, the identification of low-income households, older people, and residents facing housing-related constraints reflects a recognition dimension, as it draws attention to differences in vulnerability and in the practical capacity of particular groups to participate in the transition (Jenkins et al. 2016). Procedural justice is less directly captured by the present data, as the study did not examine residents' actual participation in energy-related decision-making processes. It nevertheless remains relevant to the broader question of whether groups with limited capacity to become individual prosumers are adequately represented in the design of local energy policies and support mechanisms.

The responses concerning the allocation of public support further reinforce this interpretation. Respondents most frequently prioritised households at risk of energy poverty and older people, indicating that

vulnerability is perceived as a relevant criterion in the distribution of limited public resources. This finding suggests support for a needs-sensitive approach to energy-transition policy, in which public intervention is used not only to stimulate investment but also to reduce disparities in the capacity of different social groups to participate in and benefit from prosumer-energy development.

These findings also have broader normative implications for the assessment of justice in the energy transition. If the capacity to participate in prosumer energy is systematically shaped by income, housing conditions, age, or access to investment resources, policies based exclusively on formally equal access to support may be insufficient to ensure substantively equitable outcomes. From this perspective, a just transition requires attention not only to the distribution of benefits and the recognition of differentiated vulnerabilities, but also to the institutional mechanisms through which existing or emerging inequalities can be addressed.

This consideration also creates a conceptual link with restorative justice, which draws attention to the need to identify and remedy harms or inequalities generated or reinforced by energy systems and transition processes (Heffron & McCauley 2017). Restorative justice was not operationalised as a separate empirical dimension in the present study; consequently, the findings do not permit its direct assessment. Nevertheless, respondents' preference for directing support towards groups perceived as particularly vulnerable suggests the relevance of corrective and inclusion-oriented policy mechanisms within the broader normative framework of a just energy transition. This dimension warrants more explicit empirical investigation in future research.

4.3. Environmental Responsibility Between Individual Action and the Role of Local Government

The findings relating to RQ3 reveal a notable distinction between the perceived environmental responsibility of individuals and the perceived institutional responsibility of local government. Respondents generally associated the development of prosumer energy with greater environmental responsibility among residents, suggesting that active participation in energy generation may be perceived as conducive to greater awareness of the environmental consequences of energy-related choices. This interpretation is consistent with approaches that conceptualise prosumers not merely as consumers who also generate energy, but as active participants whose everyday practices may contribute to broader processes of environmental engagement and citizen participation (Campos & Marín-González 2020; Parra-Domínguez et al. 2023).

A different pattern emerges, however, in relation to the role of municipalities in actively shaping pro-environmental attitudes. The absence of a clear consensus, together with the relatively high proportion of

respondents who selected "difficult to say", suggests that the institutional responsibility of local government in this area is perceived less clearly than the relationship between prosumerism and individual environmental responsibility. This uncertainty should not be interpreted simply as a lack of interest. Rather, it may reflect ambiguity concerning the appropriate division of responsibility between individual citizens, local authorities, market actors, and higher levels of government in promoting environmentally responsible energy behaviour.

This finding resonates with research emphasising that citizen participation in decentralised energy systems is shaped not only by individual motivations but also by institutional, regulatory, and organisational conditions (Wahlund & Palm 2022). From this perspective, environmental responsibility should not be framed as an exclusively individual obligation. Local governments may play an enabling rather than solely directive role by providing information, facilitating access to support mechanisms, coordinating local initiatives, and creating institutional conditions that make environmentally responsible choices more accessible to different groups of residents (Campos & Marín-González 2020; Parra-Domínguez et al. 2023). This enabling role is also reflected in recent Polish research highlighting the importance of municipal support and citizens' awareness in shaping local energy-transition processes (Jonek-Kowalska 2026).

The findings therefore point to an important distinction between the individualisation and institutionalisation of environmental responsibility. Prosumer energy may encourage residents to assume a more active role in the energy transition, but the extent to which this process develops into broader and more inclusive environmental engagement may depend on the institutional environment in which individual choices are made. The contribution of municipalities may therefore lie less in directly shaping residents' attitudes than in creating conditions that enable participation. This interpretation extends the discussion beyond individual environmental behaviour and highlights the importance of shared responsibility between citizens and public institutions in local energy transitions.

4.4. Value Conflicts and the Importance of Energy Security

The findings relating to RQ4 confirm that the local dimension of the energy transition involves not only choices between technologies or policy instruments but also tensions between competing public values. When confronted with a potential conflict between climate protection and landscape protection, respondents most frequently regarded both objectives as equally important rather than assigning categorical priority to

either. At the same time, the substantial proportion of non-committal responses indicates that such conflicts may be difficult to resolve through a simple hierarchy of environmental values.

This finding is consistent with theoretical perspectives that conceptualise the energy transition as a process that is not axiologically neutral and that inevitably involves tensions between competing environmental, social, economic, and spatial values (Devine-Wright 2009; Siciliano et al. 2021; Eichenauer & Gailing 2022). Renewable-energy development may simultaneously advance climate objectives while generating concerns relating to landscape protection, spatial order, local identity, property interests, or the distribution of costs and benefits. The present findings suggest that representatives of rural municipalities recognise this multidimensional character of local energy-transition conflicts rather than treating climate objectives as automatically overriding other locally relevant values.

A different hierarchy emerges when respondents are asked to identify the highest priority of local energy policy. In this context, reducing energy costs and strengthening energy security clearly outweigh explicitly environmental and participatory objectives. This contrast is analytically significant. While respondents strongly recognise the environmental and climate-related benefits of prosumer energy, their priorities for local energy policy appear to be shaped more directly by immediate economic and energy-security concerns. The findings therefore suggest a distinction between the values attributed to prosumer energy as a component of the transition and the criteria used to prioritise local policy objectives.

This interpretation is further supported by the strong assessment of the potential contribution of prosumer energy to municipalities' resilience to energy crises and rising energy prices. This pattern is consistent with research highlighting the growing importance of energy security and resilience within contemporary energy transitions (Hoicka et al. 2021; Neij et al. 2025). Importantly, the prominence of these concerns suggests that the local legitimacy of prosumer-energy development may be strengthened not only by climate-related arguments but also by its perceived capacity to address more immediate concerns relating to affordability, security, and vulnerability to external energy shocks.

Taken together, the findings support an understanding of the energy transition as a process of balancing competing values rather than maximising a single objective. From a local-governance perspective, long-term climate and environmental goals must coexist with immediate concerns relating to affordability, energy security, spatial development, and residents' expectations. The role of local government may therefore be

understood not simply as implementing predetermined transition objectives, but also as mediating between competing values and translating broader climate and energy goals into locally legitimate policy choices.

4.5. Integrating the Dimensions of Prosumer Energy in the Sustainable Energy Transition

Considered jointly, the findings indicate that the perceived role of prosumer energy in the sustainable energy transition of rural areas is multidimensional. Its environmental and climate-related functions are the most consistently recognised, while its contribution to energy security and resilience is also assessed strongly. By contrast, questions relating to distributive justice, institutional responsibility, and competing local values generate more differentiated and uncertain assessments. This pattern indicates that the technological and functional dimensions of prosumerism may currently be more firmly embedded in local-government perceptions than its social and participatory dimensions.

The analytical dimensions examined in this study are also interdependent. Unequal access to prosumer energy may influence both energy justice and the distribution of resilience benefits. Environmental responsibility may affect willingness to participate in decentralised energy initiatives, while institutional support may determine whether such participation extends beyond households with relatively high financial and organisational capacity. Value conflicts, in turn, may shape the social legitimacy of renewable-energy development and the ability of local authorities to implement transition policies effectively.

These interdependencies support the conceptualisation of prosumer energy as a socio-technical and institutional phenomenon rather than merely a form of distributed electricity generation. From this perspective, the contribution of prosumer-energy development to a sustainable transition cannot be assessed exclusively through installed capacity, emission reduction, or technological diffusion. It also depends on whether decentralised energy contributes to inclusive participation, equitable access to the benefits of the transition, locally legitimate decision-making, and communities' capacity to respond to energy-related disruptions.

The findings therefore reinforce the value of an integrated analytical framework in which sustainable energy transition, and citizen and community energy provide the overarching conceptual context, while environmental and climate objectives, energy justice, environmental responsibility, value conflicts, and energy resilience constitute interconnected dimensions of empirical analysis. This integrated perspective represents one of the principal conceptual contributions of the study.

The principal relationships identified across the five analytical dimensions are synthesised in the descriptive model presented in Figure 2.

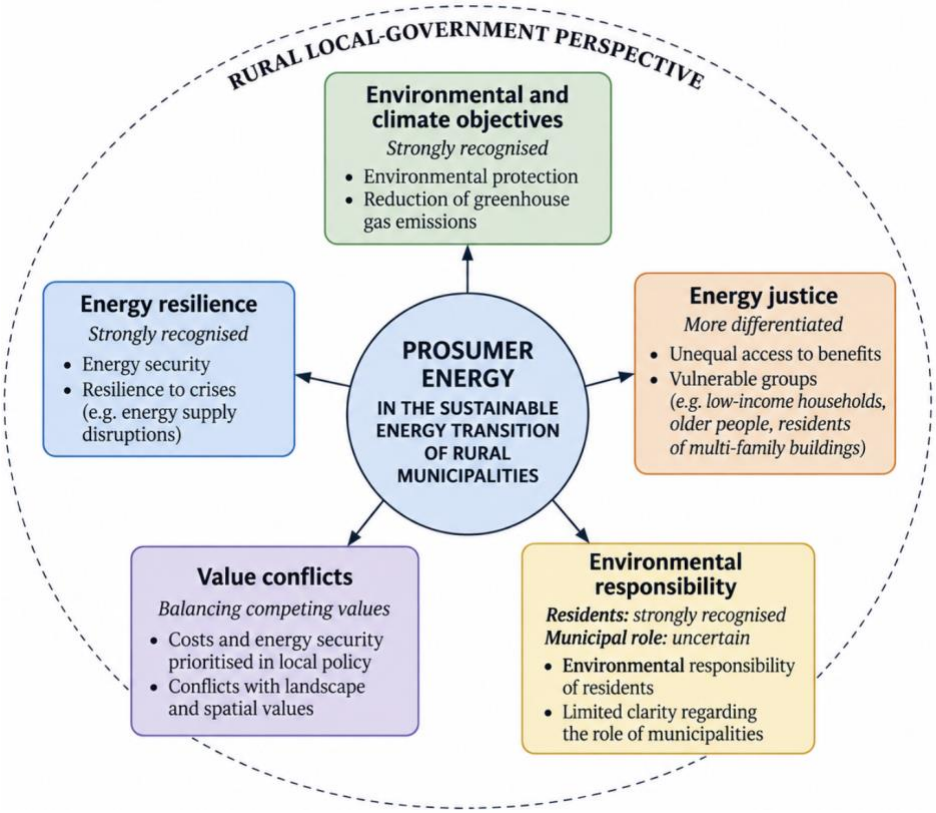


Figure 2. Descriptive model of the perceived role of prosumer energy in the sustainable energy transition of rural municipalities.

Source: Author's own elaboration based on survey results.

5. Implications

The findings of this study have implications in three interrelated areas: theoretical, policy and practice, and normative. At the theoretical level, they contribute to understanding the multidimensional role of prosumer energy in rural energy transitions. At the policy and practical levels, they highlight the importance of designing support mechanisms that respond to differentiated social and institutional conditions. At the normative level, they raise broader questions concerning justice, responsibility, inclusion, and the reconciliation of competing public values within the energy transition.

The findings have implications both for research on the energy transition and for the design of public policies. From a theoretical perspective, the study indicates that representatives of rural municipalities perceive prosumer energy primarily through its environmental, climate-related, and energy-security functions, while its social dimension receives comparatively less emphasis. The findings therefore indicate a need for

further research on the social dimension of the energy transition and on the role of local governments in the development of citizen energy initiatives.

From a public policy perspective, the results highlight the importance of incorporating the principles of energy justice into the design of support instruments for prosumer energy. Particular attention should be devoted to programmes targeting groups identified as being most vulnerable to exclusion from the benefits of the energy transition.

The findings further suggest that measures supporting the development of renewable energy sources may be legitimised more effectively by referring not only to environmental arguments but also to issues of energy security, community resilience, and the reduction of energy costs.

5.1. Theoretical Implications

The principal theoretical contribution of the study lies in showing that the role of prosumer energy in the energy transition of rural areas is perceived as multidimensional. The findings show that environmental, climate-related, and energy-security functions are recognised more consistently than social and participatory dimensions. This asymmetry suggests that the conceptualisation of prosumerism as a form of citizen energy and a mechanism for the democratisation of energy systems is not necessarily reflected to the same extent in local-government perceptions.

The study therefore contributes to the literature by integrating several analytical perspectives that are often examined separately, including sustainable energy transition, energy justice, environmental responsibility, value conflicts, and energy resilience. Considered jointly, these dimensions reveal that prosumer energy cannot be adequately understood solely as a technological or economic phenomenon. Its significance also depends on questions of access, institutional capacity, social participation, local legitimacy, and the distribution of resilience benefits.

A further theoretical implication concerns the relationship between the different dimensions of the transition. The findings, interpreted within the adopted theoretical framework, suggest a potential relationship between energy justice and energy resilience, as unequal access to prosumer-energy technologies may also result in unequal access to resilience benefits. Similarly, environmental responsibility is shaped not only by individual attitudes but also by the institutional conditions that enable or constrain participation. These interdependencies support the use of an integrated analytical framework rather than treating the individual

dimensions of the energy transition as conceptually isolated.

Finally, the study highlights the analytical value of incorporating the perspective of local-government representatives. Existing research on prosumer energy has largely focused on households, individual prosumers, energy communities, and market or regulatory mechanisms. The present findings highlight the analytical importance of local-government perspectives, given the position of local authorities at the intersection of national policy objectives, local development, spatial planning, public services, and community interests.

5.2. Policy and Practical Implications

From a policy and practical perspective, the findings indicate that support for prosumer-energy development should not be designed solely around technological diffusion or investment capacity. The identification of low-income households, older people, and residents facing housing-related constraints as groups particularly vulnerable to exclusion suggests that formally equal access to support mechanisms may not be sufficient to ensure equitable participation in the energy transition. Policy instruments should therefore take account of differences in residents' capacity to invest, access information, and participate in decentralised energy systems.

The findings also suggest that energy-justice principles should be incorporated more explicitly into the design of public support instruments. This may involve greater targeting of vulnerable groups, differentiated forms of financial and organisational assistance, and support models that do not depend exclusively on individual household ownership of suitable property. In rural areas, collective and community-based arrangements may be particularly relevant where individual prosumer models are inaccessible or economically difficult to implement.

A further practical implication concerns the role of local governments. Rather than being viewed solely as implementers of national energy policy, municipalities may act as enabling institutions by providing information, coordinating local initiatives, facilitating access to funding, supporting environmental education, and creating conditions for broader citizen participation. Such a role may be particularly important where residents face organisational, informational, or financial barriers to participation in prosumer-energy development.

The findings further suggest that public support for renewable-energy development may be strengthened by presenting prosumer energy not only in terms of climate and environmental objectives but also in relation to issues that are more immediately relevant to local communities, including energy affordability, energy security, and resilience to external shocks. The strong emphasis placed by respondents on reducing energy costs and strengthening energy security suggests that these considerations may constitute particularly important drivers of local support.

At the same time, local energy policies should avoid treating climate, economic, spatial, and social objectives as mutually exclusive. The findings concerning value conflicts indicate that local authorities may need to play a mediating role in reconciling renewable-energy development with landscape protection, spatial order, affordability, and community expectations. This requires decision-making processes that are transparent, context-sensitive, and capable of recognising competing local values.

5.3. Normative Implications for a Just and Sustainable Energy Transition

The findings also carry normative implications that extend beyond the empirical assessment of prosumer energy and concern the principles by which a just and sustainable energy transition in rural areas should be evaluated. In particular, they raise questions concerning distributive fairness, the allocation of responsibility, the recognition of vulnerable groups, and the reconciliation of competing public values.

These questions also concern the ethical quality of human–environment relations shaped by the energy transition. A transition may be environmentally effective in terms of emission reduction while remaining ethically deficient if it excludes vulnerable groups, weakens local participation, or treats communities merely as recipients of technological change. From this perspective, the normative assessment of prosumer energy should consider not only environmental outcomes, but also whether the transition strengthens responsible, inclusive, and participatory relationships between people, institutions, and the environment.

First, prosumer energy should not be assumed to be inherently just merely because it contributes to renewable-energy deployment or decarbonisation. The findings indicate that the capacity to participate in and benefit from prosumer-energy development may differ substantially between social groups. From the perspective of energy justice, this means that the fairness of the transition depends not only on the expansion of renewable-energy technologies but also on how their benefits, costs, and opportunities are distributed. A

transition cannot be regarded as substantively just if participation remains disproportionately dependent on financial resources, housing conditions, technical capacity, or other structural advantages.

Second, the findings support a conceptualisation of environmental responsibility as shared rather than exclusively individual. Although prosumer energy is perceived as contributing to greater environmental responsibility among residents, the less clearly defined role attributed to municipalities raises the risk of an excessive individualisation of responsibility for the transition. A sustainable transition requires responsibilities to be distributed across individuals, local governments, national authorities, market actors, and other institutions according to their respective capacities and spheres of influence. Municipalities may therefore have an important enabling role in supporting environmental education, participation, access to information, and the inclusion of groups whose capacity to engage independently in the transition is limited.

Third, the findings reinforce the view that the energy transition is not value-neutral. Decisions concerning renewable-energy development may involve tensions between climate protection, landscape preservation, affordability, energy security, social participation, and local autonomy. These objectives cannot always be maximised simultaneously. The normative legitimacy of transition policies therefore depends partly on the procedures through which competing values are recognised, negotiated, and reconciled. From this perspective, just and sustainable energy governance requires not only technically effective solutions but also transparent and socially legitimate processes of prioritisation.

Finally, a just and sustainable energy transition should be evaluated through a broader set of criteria than emission reduction alone. Its assessment should also encompass social inclusion, meaningful participation, recognition of differentiated vulnerabilities, intergenerational responsibility, and the capacity of communities to benefit from and adapt to systemic change. Prosumer energy may contribute to these objectives, but its contribution is conditional rather than automatic. It depends on whether institutional and policy arrangements are capable of preventing the reproduction of existing inequalities while enabling broad and meaningful access to the benefits of decentralised energy development.

6. Limitations and Future Research

The study has several limitations that should be considered when interpreting the findings.

First, the study was based on respondents' self-reported assessments and focused on perceptions of prosumer energy among representatives of rural municipalities. Consequently, the findings should not be

interpreted as direct measures of the actual level of prosumer-energy development or of its objectively measured social, environmental, or economic effects in individual municipalities.

Second, despite the relatively large final sample, nationwide territorial coverage, and high response rate, the sample was not proportionally stratified by voivodeship. The findings should therefore be interpreted as reflecting general patterns in the perceptions of representatives of rural municipalities rather than as a basis for detailed interregional comparisons.

Third, the study employed a cross-sectional design and therefore captures respondents' perceptions at a specific stage of the energy-transition process. It does not allow changes in attitudes over time to be assessed or the effects of future regulatory, technological, economic, and geopolitical developments to be determined. Longitudinal research would be valuable for examining whether local-government perceptions evolve as prosumer-energy systems and support mechanisms develop.

Fourth, the present study represents the first, exploratory stage of a broader research programme and therefore focuses primarily on descriptive analysis. The collected dataset offers substantial potential for further examination using bivariate and multivariate statistical methods. Future research may include correlation analysis, dimensionality-reduction techniques, clustering methods, and explanatory or predictive modelling in order to identify relationships between the analysed dimensions and factors differentiating perceptions of prosumer energy across municipalities. These analyses fall beyond the deliberately defined scope of the present exploratory study and will constitute a subsequent stage of the research programme.

Future research should also extend the analysis to other stakeholder groups, including rural residents, individual prosumers, representatives of energy communities and cooperatives, local entrepreneurs, and other actors involved in decentralised energy development. Comparative research involving rural, urban-rural, and urban municipalities would make it possible to identify whether perceptions of prosumer energy differ systematically across territorial contexts. Another important direction would be to examine the relationship between the actual level of prosumer-energy development in individual municipalities and the perceptions expressed by local-government representatives. Combining perceptual data with objective indicators of renewable-energy deployment, socioeconomic conditions, energy poverty, and local institutional capacity could provide a more comprehensive understanding of the determinants and consequences of prosumer-energy development.

Conclusions

This study examined how representatives of rural municipalities in Poland perceive the role of prosumer energy in the sustainable energy transition. The findings indicate that prosumer energy is widely perceived as an important component of this transition, particularly in relation to environmental protection, greenhouse-gas reduction, energy security, and the resilience of local communities to energy-related disruptions.

At the same time, the study reveals a clear asymmetry in these perceptions. Environmental, climate-related, and energy-security functions are recognised more consistently than the broader social and participatory dimensions of prosumerism. Prosumer energy is therefore perceived primarily as an instrument of technological and energy-system transformation, while its potential contribution to citizen participation, community development, and broader social change receives comparatively less emphasis.

The findings also indicate that positive perceptions of prosumer energy coexist with differentiated assessments of its implications for energy justice. Respondents identified differences in income, age, and housing conditions as potential barriers to participation in and access to the benefits of prosumer-energy development. This highlights the importance of ensuring that the development of decentralised energy systems does not reproduce or reinforce existing inequalities.

A further conclusion concerns the role of local government. The results suggest that municipalities occupy an important position at the intersection of national energy objectives, local development, spatial conditions, and community interests. Their role may therefore extend beyond facilitating renewable-energy investment to creating institutional conditions that support broader participation, access to information, and the inclusion of groups with more limited capacity to engage independently in the energy transition.

Taken together, the findings support a multidimensional understanding of prosumer energy. Its contribution to the sustainable energy transition should not be assessed solely in terms of technological deployment or emission reduction but should also be considered in relation to justice, responsibility, local legitimacy, and resilience. The principal contribution of the study lies in showing how these dimensions are perceived by representatives of rural municipalities, whose perspectives have received comparatively limited attention in previous research.

Because the study is exploratory and based on descriptive analysis of self-reported assessments, the findings should be interpreted as identifying dominant patterns of perception rather than establishing causal

relationships or objectively measured effects of prosumer-energy development. Further research should build on this initial stage by combining survey-based assessments with more advanced statistical analyses and objective indicators of renewable-energy deployment, socioeconomic conditions, and local institutional capacity.

Overall, the study suggests that the long-term contribution of prosumer energy to a just and sustainable rural energy transition will depend not only on the expansion of renewable-energy technologies, but also on whether the institutional and policy environment enables broad access to transition benefits, recognises differentiated vulnerabilities, and supports meaningful participation in shaping local energy futures.

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