

# PROSUMER ENERGY AS AN OPPORTUNITY FOR THE DEVELOPMENT OF RURAL COMMUNITY IN POLAND

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**Abstract:** *Prosumer energy is currently one of the main directions of agricultural development in Poland. Prosumer activity can bring many benefits, e.g.: ensure a stable energy supply, use waste generated by agricultural production, lower production costs, ensure social development. The aim of the article is to present the importance of prosumer energy in agricultural production to the development of rural community in accordance with the concept of sustainable development.*

**Keywords:** *prosumer energy, sustainable agricultural development, rural community.*

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## 1. INTRODUCTION

Agriculture is one of the most important branches of Polish economy. Agricultural land, which occupies 18776.5 thousand hectares, accounts for 60% of the country's total area. The total number of agricultural farms is 1.4 million, while the number of people living in rural areas and working in agriculture is over 15.3 million (almost 40% of the total population in Poland). [11] In the last several years the development of agriculture in Poland has been quite dynamic. Both technical and technological progress is visible, as well as the increasing awareness of the rural community in terms of protection of the surrounding natural environment. Much attention is currently paid to activities aimed at the development of dispersed energy generation using renewable energy sources (RES) and prosumer activities in this area. They are an element of sustainable development aiming at social and economic progress and taking into account the protection of the natural environment against pollution from agricultural production.

According to the energy policy of the European Union [7], the share of RES energy in total energy consumption should be at least 20% (15% in the case of Poland). According to data from the Central Statistical Office [11], the share of renewable energy in the EU-28 countries in 2016 amounted to 27.9% in total and increased by 3.3 percentage points from 2013 onwards (Tab. 1). Among EU countries, the highest share of RES was recorded in Lithuania, Austria, Italy, Finland, Germany and Slovakia. In Poland, on the other hand, in 2016 it amounted to 13.6% and increased from 2013 only by 1.5 percentage points.

The agricultural sector is the largest contributor to the achievement of the EU targets related to renewable energy sources. [18], [20] Despite the fact that in Poland the rate of RES development is quite slow, a gradual progress can be observed in terms of investment into green energy sources. In the last 8 years, the number of agricultural biogas producers and installations has increased from 4 and 8 in 2011 to 86 and 96 in 2018, respectively (Fig. 1). The total capacity of the installed agricultural biogas installations in 2018 was over 4 million cubic meters, while the total electrical capacity of the installation was 102.786 MWe, of which the smallest installation was 0.080 MWe and the largest - 2.400 MWe [12].

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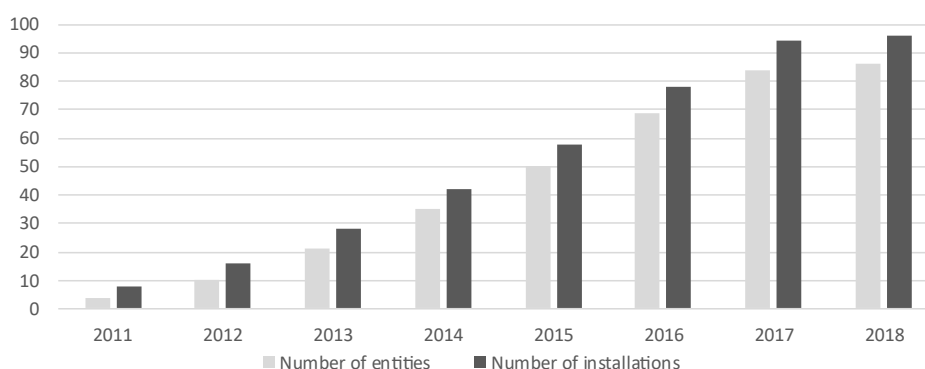
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**Table 1:** Share of energy from renewable sources in primary energy in Poland, EU-28 and selected EU member states in 2013-2016 (%)

Description	2013	2014	2015	2016
Poland	12,1	12,1	13,1	13,6
UE-28	24,6	25,6	26,8	27,9
Lithuania	91,1	91,3	92,5	92,5
Austria	77,6	76,9	77,8	79,1
Italy	63,7	64,2	65,2	70,5
Finland	55,2	55,9	59,3	59,9
Germany	28,0	30,1	32,5	34,1
Slovakia	22,9	22,8	25,2	25,9
France	17,1	15,7	16,0	18,3
Czech Republic	13,5	14,2	14,9	15,8
Netherlands	6,3	7,6	9,9	10,2

Source: the author based on [11].



**Figure 1:** Number of entities and installations in the register of agricultural biogas producers in the years 2011-2017 (as of 1 January 2019) Source: the author based on [12]

Agriculture has a very high potential of biomass, which is used for energy production, and an equally high potential of liquid and gaseous fuels. In 2017 a total of about 3.8 million tons of raw materials was used for the production of agricultural biogas; most of it was slurry - over 21%, followed by distillers' soluble and residues of fruit and vegetables (Table 2). [12]

**Table 2:** Selected raw materials used for agricultural biogas production in 2017

Raw material	Consumption (thousand tons)
Slurry	807
Distillers' soluble	762
Residues of fruit and vegetables	757
Maize silage	472
Beet pulp	280
Green fodder	96
Manure	83
Grass and cereal silage	25
Avian manure	21
Straw	12

Source: the author based on [12]

Thanks to the growing number of biogas installations, the production of agricultural biogas, and thus the amount of electricity and heat, also increases every year (Table 3). In 2011, 73.4 GWh of electricity was produced from 37.7 million m<sup>3</sup> of biogas, while in 2018, almost 8 times more agricultural biogas was produced, from which 608.3 GWh of electricity was obtained. [12]

**Table 3:** Production of agricultural biogas, electricity and heat from agricultural biogas in 2011-2017

Year	Quantity of agricultural biogas produced (million m <sup>3</sup> )	Amount of electricity produced from agricultural biogas (GWh)	Amount of heat produced from agricultural biogas (GWh)
2011	37,7	73,4	82,6
2012	73,2	141,8	160,1
2013	112,4	227,9	246,6
2014	174,3	355,0	373,9
2015	206,2	429,4	225,0*
2016	250,2	524,5	bd
2017	291,7	608,3	bd

\*data for Q1 and Q2 2015; n.a. - not available

Source: the author based on [12]

The data presented above are optimistic, but further development of renewable energy in the agricultural sector still requires many actions, e.g. in terms of legal regulations, reduction of costs of green energy production or availability of financial support. It is also indispensable to activate Polish farmers, who still show a low propensity to undertake collective actions [18].

The aim of the article is to present the importance of prosumer energy in agricultural production to the development of rural community in accordance with the concept of sustainable development.

## 2. PROSUMER ENERGY IN AGRICULTURAL ACTIVITY IN THE CONCEPT OF SUSTAINABLE DEVELOPMENT

The concept of sustainable development is now applied in all sectors of the economy, including agriculture, where it refers to important social, ecological and economic values, creating a new approach to the principles of management and living in the rural environment. These values make it possible to ensure balance through the use of renewable natural resources, climate protection, introduction of new technologies as a strategy related to all aspects of sustainable agricultural production or protection of social interests. [1], [2], [3], [4], [5], [14]

The concept of sustainable development is particularly important in agriculture and rural areas, as it takes into account the need to achieve strategic development objectives. However, these actions face many social, economic, intellectual and ethical difficulties. They include a low level of affluence of the inhabitants, limited investment opportunities, low level of education and ecological awareness of the inhabitants, as well as tolerance for inappropriate behaviour.

The implementation of the concept of sustainable development is an important direction of the development of agricultural activity and rural areas in Poland. Efforts are made to improve the quality of life of the rural community, and an active participation in innovative activities is observed. These activities consist, among others, in the development of a model of low-emission, innovative and more effective agriculture.

A new direction of activities in the economy, i.e. prosumerism, is helpful in this respect. Prosumerism is a certain set of behaviours and social attitudes (of prosumers), where the maximisation of material benefits, as well as intangible benefits, those resulting from the production

process and those arising at the moment of consumption, is considered as a determinant of the value of a product

The term „prosumer” was introduced in 1980 by Alvin Toffler. Initially, it meant a proactive consumer whose aim was to design and improve goods and services. Nowadays, it means a consumer who consumes what he produces [13].

According to Paltrinieri & Esposti [16], the introduction of the new term has led to a better understanding of the social changes resulting from the development of social media, as well as the role of the consumer who participates in these changes. Therefore, being a prosumer means, first and foremost, being involved in production and consumption processes and having a social role and function resulting from the opportunities offered by digital technology and augmented reality. In this way, civic engagement and building relationships based on specific interests, mutual trust and thus mutual support are promoted.

In today’s economy, both in Poland and around the world, prosumers are becoming increasingly important in the consumer market. They constitute a growing group of users thanks to technological changes, access to modern solutions and the Internet. The essence of prosumer activity is to interact with various companies. Nowacki [15], referring to the cooperation of prosumers with enterprises, distinguished several types of prosumers based on the criterion of involvement in the cooperation process:

- Level I - active users who make little contribution through the social networks of which they are members;
- Level II – engaged users who create ideas for the enterprise. The enterprise offers these ideas only to the co-creating prosumer;
- Level III – an innovative user who creates innovations for other prosumers or enterprises that use them exclusively for their own needs;
- Level IV – partners of the enterprise, who, together with the enterprise, jointly create innovations subsequently offered to all buyers;
- Level V – co-creators of the market, who build an E2E (*everyone-to-everyone*) market where everyone works together;
- Level VI – market creators who create sectors on their own with the participation of other prosumers.

Currently, a lot of attention is paid to prosumer energy, which, through the implementation of basic aspects of sustainable development, is one of the most important trends in the field of renewable energy. Newly emerging RES technologies may ensure both environmental protection and stimulate the country’s economic development, increase competition on the energy market and introduce innovations in the energy sector. Agriculture and rural areas, where there is a huge potential for the future energy market, occupy a special place in the implementation of the principles of sustainable development. Thanks to the development of social capital in the field of prosumer energy among the inhabitants of rural areas, taking into account the increase in their ability to act collectively through prosumer groups, including cooperatives, it is possible to create synergistic effects, create interactive information exchange models/procedures and conduct social dialogue.

Prosumer energy (PE) implemented in the agricultural sector can generate many benefits, e.g. ensure stable energy supply, use waste generated by agricultural production, reduce production costs, protect the natural environment, promote local development, ensure social development,

and increase the competitiveness of enterprises. The rural community has an opportunity to become involved in these activities, *inter alia* through the acquisition of new knowledge, modernisation of farms and implementation of new technologies. The creation of prosumer groups may constitute an important counterbalance for both state and market units. It is important to develop tools that will enable the use of RES installations both for energy production and sanitation of animal production in order to reduce its pressure on the environment.

Increasing energy efficiency and minimizing energy consumption are the main elements of energy strategies of highly developed countries. Parallel to this there is also the question of sources from which households, enterprises and institutions are supplied with electricity. Currently, Poland's energy mix is not favourable from the point of view of energy efficiency, energy generation costs and emissions of harmful substances into the atmosphere. Combined with the growing demand for energy and the unsatisfactory condition of the generation and transmission infrastructure, it does not guarantee full and effective protection of the country's energy needs. In this respect, there is a need to increase the share of renewable energy in the energy balance, especially on a local scale, to support the production of energy by prosumers and to protect them, which in turn gives a chance to meet these challenges.

The name *prosumer* refers to every type of economic activity, but in the case of agriculture it is an evolutionary process with a change in thinking and, as a consequence, the transformation of the energy sphere. Prosumers enable the production and use of energy at local level to become a natural stimulus for rural development and a factor in the continuous improvement of the quality of life of the rural community [10].

### **3. DEVELOPMENT OF THE RURAL COMMUNITY IN THE PROCESS OF PROSUMER ENERGY GENERATION**

The increase in the number of prosumers is an extremely expected trend. This may contribute to the widespread use of renewable energy sources, the development of additional economic activities, as well as an increase in energy security. In this respect, there is a need for legislative, administrative and financial support, i.e. undertakings aimed at the development of a dispersed generation [6].

In modern farms the demand for electricity and heat is growing, which is also associated with higher costs. Therefore, it is important to implement an economy based on renewable energy sources and to strive for energy self-sufficiency of agricultural farms through the development of prosumer energy. There are many possible applications of RES in Poland. Current technologies for the production of electricity and heat include: biomass processing, the use of solar collectors and photovoltaics, the use of wind and water energy, the use of heat pumps and the operation of agricultural biogas plants [9].

The energy situation in rural areas is much worse than in cities. To date, access to energy sources, especially modern and low-carbon ones, has been reduced. This problem is all the more important as farmers, in addition to household energy needs, also need a significant amount of energy for agricultural work. Moreover, the use of traditional energy sources, mainly wood and hard coal (over 80% of households), dominates in agriculture. Renewable energy sources are used only to a small extent.

Among renewable energy sources, solar energy is the most commonly used. Research shows that it is associated with cleanliness of use and low operating costs. The problem of incineration of waste, mainly plastic waste in rural households, is also worth mentioning. These activities confirm the still low ecological awareness of the rural population and the resulting consequences. Therefore, it is necessary to modernise farms in rural areas, as this will allow for changes in the awareness of their inhabitants and greater use of renewable and low-emission energy sources [8].

Financial resources of rural communities are often treated as barriers to the development of agriculture and rural areas in Poland. Many inhabitants of rural areas are poor and consequently will never get a loan. Banks often refuse loans because rural applicants cannot provide sufficient repayment guarantees. In addition, the lack of knowledge about renewable energy sources, including the fear of incurring losses as a result of investments in green energy, discourages rural residents from taking action in this area. For this reason, measures are needed to satisfy the financial needs of prosumers for the reconstruction of farms and to guarantee their protection for a long time.

Research carried out by the Forum for the Development of Efficient Energy has shown that the ecological awareness of the rural population is still at a low level. In response to the choice of energy source for their farms, rural residents were guided mainly by the costs of use, installation costs, or the simplicity of operation of the energy installation. Environmental issues were less important [8].

The European Economic and Social Committee [17] considers the development of dispersed prosumer energy to be a necessary direction as a long-established element of EU energy policy, for reasons of energy security, environmental protection and social aspects. The benefits of prosumer energy are primarily related to lower energy transmission costs, better use of local energy sources and professional activation of local communities.

The creation of good relations between prosumers, other energy producers and companies dealing with energy transmission and distribution is one element of the dynamic development of prosumer energy. The creation of prosumer cooperatives is helpful in this respect. For example, in Germany prosumer cooperatives are a group of communities that support each other and are involved in the process of improving energy security in their area and optimizing solutions tailored to the needs and conditions of the community [17]. Tarhan [19] states that as early as in 2014 there were about 3000 renewable energy cooperatives in Europe, of which 80% were located in Germany and Denmark. The aim of the cooperative is energy production, sales and distribution. In a common business structure, the units share the costs, risks and duties of capital-intensive renewable energy projects. In addition, the members share the economic benefits mainly through the sale of the energy produced to the grid, the consumption of the energy produced by the members, the combination of sales and consumption and the generation of additional economic value (income stream). Revenues for cooperatives are also related to the use of guaranteed tariffs or long-term contracts for the sale of electricity from renewable sources. Cooperatives also show positive social results, e.g. through a „strong sense of community”, making joint decisions, the possibility of acquiring new knowledge and skills, generating income for the inhabitants of rural areas, strengthening the impact on raising funds related to the activity. Cooperatives also contribute to the care and protection of the natural environment by minimizing hazards and they work for the rationality of energy use.



#### 4. CONCLUSION

Prosumer energy is currently one of the desirable directions of development of farms, ensuring energy security and environmental protection. Each of the actions taken for the benefit of prosumer energy requires a holistic approach in order to implement the principles of sustainable development. The application of these principles is considered to be an integral part of all economic activity and daily practice.

The investment potential in renewable energy sources in Poland is very high. However, it is not used due to numerous barriers that hinder progress in this area. All activities supporting RES should primarily concern innovative technologies, legal support (through appropriate legal acts) and financial support of investments (through e.g. investment grants, guaranteed tariffs, subsidies, tax reliefs), reduction of energy production costs and activities aimed at activating the rural population to cooperate within prosumer cooperatives.

Therefore, we should strive for a kind of revolution, which would accelerate both the use of technical and/or technological and human potential in agriculture, as well as the possibility of obtaining many different natural sources of energy for its processing and use without adverse impact on the natural environment.

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