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SELECTED ENVIRONMENTAL ASPECTS OF SUSTAINABLE DEVELOPMENT IN RURAL AREAS

WYBRANE ASPEKTY EKOLOGICZNE ZRÓWNOWAŻONEGO ROZWOJU OBSZARÓW WIEJSKICH

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Streszczenie. Niniejszy artykuł stanowi próbę omówienia wybranych aspektów ekologicznych zrównoważonego rozwoju obszarów wiejskich. Spośród wielu aspektów ekologicznych zrównoważonego rozwoju obszarów wiejskich do przybliżenia problematyki wybrano rozwój infrastruktury gwarantującej bezpieczeństwo energetyczne na obszarach wiejskich i zwiększenie wykorzystania odnawialnych źródeł energii. Na szczeblu regionalnym kwestie dotyczące bezpieczeństwa energetycznego postrzegane są przede wszystkim przez dobrą infrastrukturę i możliwości niezakłóconych dostaw energii elektrycznej. Jednakże na silnie rozproszonych obszarach wiejskich konieczna jest dywersyfikacja źródeł energii w kierunku źródeł odnawialnych i budowy mikrosieci. Chociaż odnawialne źródła energii (OZE) nadal zaspokajają wyłącznie niewielki ułamek zapotrzebowania energetycznego kraju, to jednak dla bezpieczeństwa energetycznego stanowią istotny udział w bilansie energetycznym. Poza tym znaczący jest ich walor ekologiczny, bowiem nie emitują zanieczyszczeń do środowiska.

Key words: energy security, renewable energy sources, rural areas, sustainable development.

Słowa kluczowe: bezpieczeństwo energetyczne, odnawialne źródła energii, obszary wiejskie, zrównoważony rozwój.

INTRODUCTION

The condition of the environment does not improve instantly. It is necessary to introduce a multiphase action plan which begins with a vision of change that must occur in the environment. The end of the 20th century brought about the need to search for new human attitudes towards the surrounding natural environment. The concept of sustainable development was born. This notion started to function permanently in many walks of life.

Nowadays, more and more attention is being drawn to environmental aspects of sustainable development in rural areas. Environmental protection, however, cannot be an obstacle for their economic growth. Sustainable development should guarantee access to the natural environment for all residents in a given community, yet at the same time it should not pose a threat to ecosystems and social-economic systems (Wielewska 2011). Sustainable development should provide a balance between economic growth and environmental protection in order to ensure high standards of living for the society (Sobczyk 2014).

Respect for the principles of sustainable development with regard to energy management in rural areas ought to focus on the possibility of using renewable energy sources, as the natural

environment provides practically unlimited energy sources. Water, wind, solar radiation, geothermal energy, biomass, biogas, bio-fuels – they all constitute an environmentally beneficial alternative for scattered rural settlements.

The aim of this study is to discuss selected environmental aspects of sustainable development in rural areas.

ECOLOGICAL PRINCIPLES OF SUSTAINABLE DEVELOPMENT IN RURAL AREAS

The economic model of agriculture, which was predominant over many years, focused solely on the intensification of production and maximization of economic benefits. That paradigm, however, did not take into consideration environmental limitations or the state of renewable natural resources. This led to a disturbance in the balance of the natural environment – water and air pollution, soil degradation, etc. (Roszkowska-Mądra 2011).

The negative effects of this kind of activities include not only the soil and water contamination with chemicals, but also the creation of large areas of monocultures, degradation of pastures and meadows, liquidation of forestation and small water bodies, and consequently – impoverishment of biological diversity (Kowalczyk-Juśko 2005).

Each action in the environment has an impact on it. Every kind of production, every element of animate and inanimate nature is coupled with another element which influences the environment (Wielewska 2005). The perception of negative changes and a number of threats to the natural environment caused new needs and expectations concerning rural areas to arise.

Agriculture serves multiple purposes (Table 1).

Table 1. Functions of agriculture according to Wilkin (2010)

Production	Social	Cultural	Natural
Commercial: – foods – agricultural goods for the industry – agricultural goods for the production of energy – touristic services related to agricultural activity Non-commercial: – self-supply of food in the household – means of production produced in the household, for own consumption	– impact on economic activity and social coherence of the country – element of social security for farmers' families and part of non-farmers' families – stabilizer of shocks caused by economic and institutional changes	– protection and enriching cultural traditions in the country – enriching the national culture – strengthening the national identity and cultural diversity on local and regional levels – forming cultural capital – protection and enriching the cultural landscape of the country	Negative: – pollution of the soil with chemicals and sewage – soil erosion – decreasing the biological diversity of the farming areas – greenhouse gas emission Positive: – prevention of environmental degradation of agricultural areas – protection of biological diversity of agricultural areas – protection or improvement of hydrographic conditions in agricultural areas – prevention of soil erosion

Source: Wilkin 2010. Multifunctionality of agriculture. Research directions, methodological bases and practical implications, IRWiR PAN Publishing House, Warsaw. 29.

Due to many social and economic changes, rural areas are not exclusively used by farmers. The function of producing agricultural raw materials and food is not sufficient to ensure

development to the rural areas and therefore, the launch of other types of social and economic activity could often be observed (Baran and Grzebyk 2011). With time, agriculture became merely one of the co-hosts of rural areas, and the productive function ceased to be the only function of those areas.

In turn, Zegar (2004) argues that in recent years the benefit of environmental services provided by agriculture caught up with, or even exceeded the values of agricultural products which are produced to satisfy the food demand of the populace. Agricultural functions of the country are enriched by the functions of producing renewable raw materials for the needs of the fuel and energy industries, as well as typically environmental functions, where the farming household is placed as a guard of the natural environment (Baran and Grzebyk 2011).

It has been agreed that rural areas in the EU member states should be developed with some consideration for the concept of multi-functional development, the essence of which is to introduce into rural areas such non-agricultural functions as: tourism or environmental protection (Kapidura et al. 2011). In result, there was a turn towards environmental issues, which triggered the evolution of economy towards sustainable development.

In the environmental aspect, sustainable development is considered to be a process which is supposed to reduce the pressure on the environment and to improve its condition by means of "greening" the economic processes and introducing integrated systems of environmental protection (Górka et al. 2001). The fundamental principles of the so-defined development are based on the following factors:

- comprehensive and long-term planning of social-economic development, considering productive and non-productive functions of rural areas,
- preservation of the continuity of natural processes and conditions for biological development,
- consideration and estimation of material and non-material (or incommensurable) resources and features of the environment (accessibility, peace, aesthetics, productivity, usefulness, diversity),
- consideration and prediction of the impact of human economic activity upon the environment, its condition and properties, mainly through exploitation of natural resources, in production and in services (the formation of non-material disturbances, e.g. the impoverishment of biological diversity as well as pollution emission, generation, storage and utilization of waste),
- consideration of feedbacks at the meeting point of ecology and economy,
- consideration and introduction of such developmental models that will not be in conflict with the factors of this development (technological progress, environmental conditions, investment processes, substitution of production factors, etc.),
- consideration of the change of quality occurring in the environment, including especially the changes which are irreversible, as well as non-linear structures, delays in time, thresholds of development, etc. (Rzeńca 2009).

The environmental aspects of sustainable development in rural areas result from the Strategy of sustainable development of the country, agriculture and fishery for 2012–2020. All the tasks to be realized in this matter have been specified in the priorities and specific goals (Table 2).

What emerges from the goals and priorities is a long-term harmony of dependencies between environmental protection and rural areas.

Table 2. Specific goals and priorities of the Strategy of sustainable development of the country, agriculture and fishery for 2012–2020

Specific goal of the Strategy	Priority
Increase in the quality of the human and social capital, employment and business activity in rural areas	<ul style="list-style-type: none"> – increasing skills, level of education and professional mobility of rural residents, – increasing the employment rate of rural residents without having to change the place of residence, – developing business activity and non-agricultural jobs using the endogenous potential of rural areas, – prevention and limitation of social exclusion and activation of rural residents.
Improvement in the conditions of living in rural areas and improvement in their spatial accessibility	<ul style="list-style-type: none"> – development of infrastructure which guarantees energy, sanitary and water security in rural areas, – development of transport infrastructure which guarantees transport accessibility of rural areas, – construction and development of infrastructure and technologies which enable rural residents to use and access ICT technology of high standards, – development of security infrastructure in rural areas.
Food security	<ul style="list-style-type: none"> – preservation and improvement in the quality of production background of agriculture and fishery, – production of high-quality, consumer-safe farming products and foods, – observation/use of the principles of fair competition in the community and global agricultural and food market, – increasing awareness and expertise of producers and consumers in food production and nutrition,
Increase in productivity and competitiveness of the agricultural and food sector	<ul style="list-style-type: none"> – modernization and increase in innovativeness of the agricultural and food sector, – creation and transfer of knowledge and technology serving sustainable development of the agricultural and food sector, – adjusting the structures of the agricultural and food sector to the changing challenges in Poland, EU and the world, – promotion and increase of the agricultural and food markets,
Environmental protection and adaptation to climate change in rural areas	<ul style="list-style-type: none"> – natural environment and biological diversity protection in the agricultural sector in rural areas, – shaping rural space, with consideration for landscape and spatial order protection, – adaptation of agriculture and fishery to climate change and their share in counteraction against these changes, – balanced forest and hunting activity in rural areas, – increasing the use of renewable energy sources in rural areas.

Source: Żmija 2014. Sustainable development of agriculture and rural areas in Poland [in: Economic policy in the period of transformation and crisis]. Edit. by A. Barteczek, A. Rączaszek, Economic Studies. Scientific Handbooks of Economic University of Katowice, Katowice. 149–154.

Amongst numerous environmental aspects of sustainable development in rural areas, the development of energy-safe infrastructure and increase in the use of renewable energy sources were selected for explaining the issue.

ENERGY SECURITY IN RURAL AREAS

Energy security is a very wide notion that escapes rigorous definitions. In a narrow sense, it is often understood as providing access to various energy carriers and continuity of their supply (Wieloński and Machowski 2008).

In a wider sense, it is defined as such a state of economy that enables satisfaction of both current and future customers' demand for fuels and energy, in a manner that is technologically and economically justified, whilst minimizing the negative impact of the energy sector upon the conditions of living of the community (Nowacki 2010).

According to a document called *Energy Policy of Poland by 2030* (2009), the basic directions of energy policy are aimed at:

- improving energy efficiency,
- increasing security of fuel and energy supply,
- diversification of electric power generation structure through the introduction of atomic energy,
- developing the use of renewable energy sources, including bio-fuels,
- developing competitive markets for fuels and energy,
- limiting the impact of energy industry upon the environment.

One of important goals of Poland's energy policy is to provide steady energy supply. This goal is conditioned by meeting the requirements of environmental protection, while maintaining economic growth (Krupnik and Brożek 2008). Energy security of each country is dependent, among others, on the diversification of the structure of energy carriers. Apart from that, the state of the local energy security is important, or the capacity to satisfy the energy demand of residents of particular regions and sub-regions (Kruk 2012).

On the regional level, the issues of energy security are mainly perceived through the capacity p of undisturbed supply of electrical energy. In the Provinces of central and southern Poland (except for the Lesser Poland Province), there is a surplus in energy production compared to its consumption. These regions are also the place where most of the energy is produced; whereas, in the northern and eastern parts of Poland, the consumption is higher than the production. This situation results from the centralization of electrical energy production and the location of the largest system power plants (Determination of energy potential... 2011).

In Polish conditions, it is particularly important for the energy security of rural areas to use local energy sources, especially those renewable, as well as to expand and modernize electric tractions. The condition of the power system in rural areas is considered to be far behind modern trends – both in terms of the traction infrastructure and quality of power.

Electrical energy production capacity from renewable energy sources is presented in Table 3.

Table 3. Electrical energy production with RES (in total) in Poland between 2006 and 2012

Year	Production capacity in GWh
2006	4 221 548
2007	5 229 525
2008	6 493 066
2009	8 604 488
2010	10 988 009
2011	12 928 808
2012	13 937 929

Source: own study based on data from the Energy Regulatory Office of Poland.

It is supposed that the size of renewable energy resources may increase along with the change of the model of energy demand and the increasing level of knowledge of their conversion into usable energy carriers and technological capabilities (Prospects... 2007).

Renewable Energy Sources still satisfy only a small fraction of the country's energy demand. However, for the energy security they do constitute a fair share in the energy balance, especially on the local scale (borough, county). One of the advantages of these sources is enhancement

of local energy security and energy supply, especially in areas with weak energy infrastructure (Program... 2006).

INCREASING THE USE OF RENEWABLE ENERGY SOURCES IN RURAL AREAS AS AN ENVIRONMENTAL ASPECT OF SUSTAINABLE DEVELOPMENT

For many years, the discussion about the energy sources in Poland has been focused on black and brown coal deposits. It seemed that those deposits would assure Poland's energy independence for a long time – but this did not happen. The brown coal reserves are being slowly depleted, and the increasing cost of black coal extraction along with lack of investment in new mines result in decreased extraction. Moreover, there is the problem of air pollution caused by the use of coal in energy industry and house heating. All this makes it necessary to direct the energy sector towards renewable sources (RES).

The expected growth in green energy between 2010–2030 amounts to 745 PJ. The surplus of water energy is estimated at 111 PJ, solar and photovoltaic – 120 PJ, geothermal – 109 PJ and wind – 115 PJ. It is clear that this growth is to be divided equally. The biggest growth will occur in biomass energy and is estimated to be 290 PJ.

The percent share of RES in the national energy balance is to increase from 7.5% in 2010 to 20% in 2030 (Table 4).

Table 4. Prospects for the development of RES in Poland [in PJ – peta joules¹]

Type of renewable energy source (RES)	Use of RES in particular years in PJ		
	2010	2020	2030
Water energy	24	82	135
Wind energy	10	43	125
Solar and photovoltaic energy	25	100	145
Geothermal and other energy	21	77	130
Energy from biomass	235	408	525
Total use of RES in Poland	315	690	1060
Share (%) of RES in the national energy balance	7.5%	15%	20%

Source: Wójcicki 2011. Renewable energy and the protection of rural environment. Infrastructure and Ecology of Rural Areas 1. 10.

In 1996, the demand for energy in Polish rural areas and agriculture amounted to 1060 PJ, and in 2010–1150 PJ. It is estimated that in 2020 it will amount to 1280 PJ, and in 2030–1400 PJ. Both the domestic use of RES and the participation of RES in the national energy balance show increasing trends. The use of renewable sources in rural areas amounted to 80 PJ in 1996 and 145 PJ in 2010. According to forecasts, it will reach approximately 273 PJ and in 2030–385 PJ. The use of RES in agriculture seems to be less dynamic: from 47 PJ in 1996 to an estimated 83 PJ in 2030 (Table 5).

¹ peta joule, 1 PJ = 10¹⁵ J

Table 5. Share of rural areas in the national energy balance of direct demand for energy carriers and the use of renewable sources in agriculture – current state and prospects

Type of prognosis parameter	Measure unit	Number of units per year					
		1996	2002	2005	2010	2020	2030
Energy demand of rural areas and agriculture	PJ	1060	1080	1010	1150	1280	1400
Participation of rural areas and agriculture in the energy needs of the country	%	25.5	25.4	25.3	25.0	24.2	23.7
National use of RES	PJ	145	170	210	345	724	1180
Participation of RES in the national energy balance	%	3.5	4.0	4.8	7.5	14.0	20.0
Use of RES in rural areas and agriculture	PJ	80	90	100	145	273	385
Use of RES in agriculture and farming households	PJ	47	49	52	60	78	83
Participation of RES in the energy balance of rural areas and agriculture	%	7.5	8.3	9.1	12.7	21.3	27.5
Participation of RES in the energy balance of agriculture	%	13.7	15.3	16.9	20.7	30.2	36.0

Source: J. Pabis, 2011. Renewable energy sources as a supplement of energy in agriculture, Agengpol, Warsaw. 9.

Advantages of the use of renewable energy sources is presented in Table 6.

Table 6. Advantages of the use of RES

Advantages	Indication
Environmental	<ul style="list-style-type: none"> – decrease in environment pollution, – limitation of emission of harmful gases into the atmosphere, – limitation of emission of dust into the atmosphere,
Economic	<ul style="list-style-type: none"> – lower cost of heat production, – lower cost of electrical energy production,
Social	<ul style="list-style-type: none"> – new jobs, – improved health of residents, – promotion of the region.

Source: own study based on: Existing and Planned Investments in RES in Kuyavian-Pomeranian Province. 2013. Minikowo, ODR.

The increase in RES production is reflected in a more diverse energy production structure; it also creates conducive conditions for the development of a more dispersed energy grid based on locally accessible resources, and, most of all, is beneficial to the natural environment by reducing air pollution from the current level to zero.

CONCLUSIONS

The aim of this study was to present selected environmental aspects of sustainable development in rural areas. Amongst numerous environmental aspects of sustainable development in rural areas, two were selected: the development of energy-safe infrastructure in rural areas and an increase in the use of renewable energy sources. Rural areas have certain particular functions arising from their specifics and conditions, which cannot be overlooked when planning energy security. The energy infrastructure in rural areas requires modernization and gradual shift to renewable energy.

Production of energy from RES causes little or no pollution emission, which translates into environmental effects. The increase in RES production may influence the diversification of the energy production structure, as well as contribute considerably to the development of scattered and prosumer energy.

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