

# ENERGY ENTERPRISES AND THE CREATION OF ECONOMIC POTENTIAL OF RURAL AREAS

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## **Annotation**

*The article aims to determine the roles of new enterprises operating in the renewable energy sector in creating the economic potential of rural areas in light of the socio-economic benefits resulting from their operation. The research was conducted on a regional scale and a detailed scale. The regional-level research included the Lubelskie Voivodeship (NUTS 2) marked by high potential, in national terms, for the production of energy from RES, and biomass in particular. The detailed research was conducted using the case study method. The entities chosen for detailed research are: wind farm, photovoltaic farm, agricultural biogas plant. The concluded research proves that the establishment and operation of RES-based energy enterprises generates economic potential of rural areas. Analyses performed on a regional scale confirm that wider use of the energy potential of the Lubelskie Voivodeship, especially based on agriculture, will help drive the activity of local communities and form the basis for creating new jobs. The study on energy enterprises helps distinguish conventional socio-economic benefits arising from the development of renewable energy in rural areas, including new jobs and cooperation with local companies, as well as other effects, e.g. the provision of local services or educational and promotional activities.*

## **Key words**

*Poland, economic potential, renewable energy, rural areas*

**JEL classification:** *R11, O13, J20*

## 1. Introduction

Socio-economic changes in Poland have caused rural areas to face new difficulties and challenges and many of them are deemed problem areas requiring specific actions to develop their economic potential. The internal potential and local resources of a region are considered its primary development drivers (Kuciński 1994, Stanny 2013). One of the key factors driving socio-economic development is the scale and dynamic of entrepreneurship (Kłodziński, 2010). Economic activity of rural areas is expressed through seeking non-agricultural forms of gaining income. One of the most prospective of those forms are investments based on renewable energy sources (RES).

The spread of renewable energy creates opportunities for the development of the economy: the use of locally available energy resources not only drives the diversification of the energy sector and improves energy security, but also contributes to the stable and sustainable development of those areas (Chodkowska-Miszczuk, 2014). As new businesses appear in the field of renewable energy, it e.g. expands the options given by the local labour market and the opportunities for obtaining additional sources of income by local residents. Munday et al. (2011) names four primary categories of socio-economic benefits resulting from the development of the renewable energy sector in rural areas: (1) classic (conventional) economic benefits, including the use of local workforce, cooperation with local companies, profit from land rental; (2) flows of financial benefits to local communities, e.g. co-financing of local funds, cheaper energy, sponsoring of local events; (3) contribution in kind to local assets and facilities, e.g. road construction and/or repairs; (4) provision of other local services, including supporting the implementation of various types of educational programs and visits. The presence of a new business entity in a given area is above all expressed by new jobs. This aspect is significant not only in terms of quantity: quality is equally important. The supply of new jobs in rural areas has a positive impact on the life quality of their residents (del Rio, Burguillo, 2008). It boosts self-esteem and thus social and local cohesion (Delicado, 2016). When considering other socio-economic outcomes produced by companies from the renewable energy sector operating in rural areas, the social context comes into the fore. More precisely, we are dealing with social embeddedness of enterprises, according to which social and economic processes are symbiotically integrated and the former may only be understood by reference to the latter, and vice versa (Stachowiak, 2011). It is crucial because business behaviour of entities which do not take into account the local social context, are not related to a specific social relationship, and are thus not socially embedded (Granvotter, 1985; Stachowiak, 2011) may give rise to the disapproval of the local community towards such companies. As a consequence, companies may be perceived by residents as the only beneficiaries of energy generation based on locally available RES. This, in turn, may lead to a situation where the benefits resulting from the presence of RES-based companies in rural areas are asymmetrical and unevenly distributed (del Rio, Burguillo, 2008).

## 2. Aim and Methods

The article aims to determine the roles of new enterprises operating in the renewable energy sector in creating the economic potential of rural areas in light of the socio-economic benefits resulting from their operation. The research was conducted on a regional scale and a detailed scale. The regional-level research included the Lubelskie Voivodeship marked by high potential, in national terms, for the production of energy from RES, and biomass in particular. The detailed research was conducted using the case study method. In order to achieve the purpose of this study, it is pivotal to consider the structure of RES technologies present in rural areas in Poland as it underpins the selection of entities analysed in detail. The entities chosen for detailed research are energy companies generating energy based on the most widespread and/or prospective RES in rural areas (Chodkowska-Miszczuk, 2014), i.e. wind energy – the wind farm in Postolin (Pomorskie Voivodeship), solar energy – the photovoltaic farm in Bordziłówka (Lubelskie Voivodeship), agricultural biogas – the agricultural biogas plant in Działyń (Wielkopolskie Voivodeship). Another hugely important factor determining the selection of the abovementioned companies is the high innovative value of the technologies applied and a similar period of operation in the local economy. The agricultural biogas plant in Działyń and the photovoltaic farm in Bordziłówka were launched in 2014, and the wind farm in Postolin in 2015.

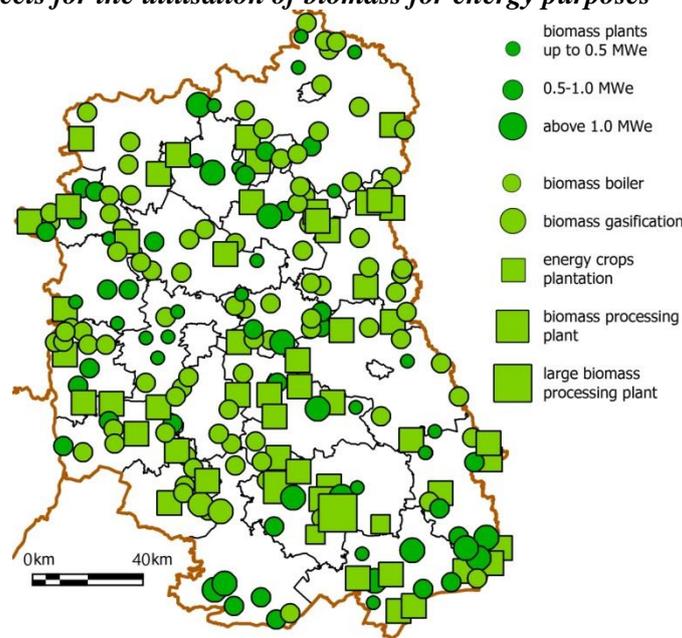
What is more, all of those entities generate electricity (and the agricultural biogas plant additionally heat) which is fed into the national power grid. Representatives of the abovementioned entities participated in in-depth interviews (combined methods: face to face, CATI, pre mail), where they provided information concerning jobs offered in individual power plants. These are the benefits which Munday et al. (2011) classifies as conventional economic benefits of the development of the renewable energy sector. The researchers also identified other positives arising from the operation of the analysed alternative power plants in rural areas, including: business flows of financial benefits to local communities (see Munday et al., 2011).

### 3. Results

#### 3.1 The potential of RES and its impact on the labour market – regional perspective

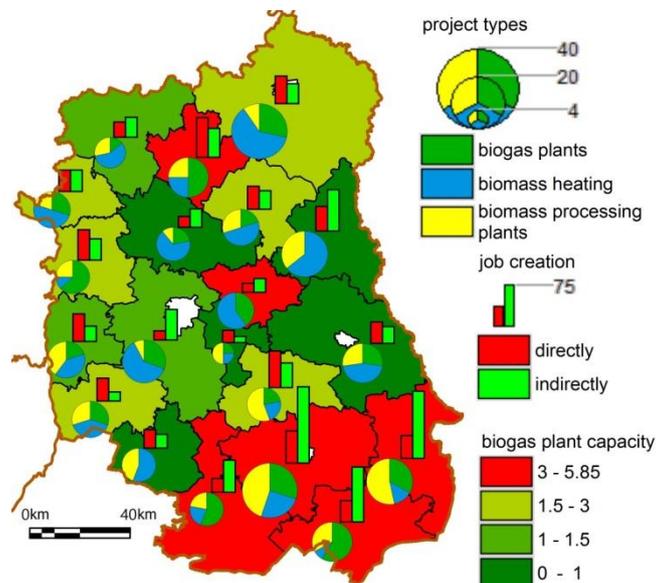
The Lubelskie Voivodeship, located in the eastern part of Poland near the border with Belarus and Ukraine, is ranked among the problem areas on the European scale. The indirect indicator of that condition is the region's GDP per capita, which in 2016 reached EUR 7,700 (Eurostat). The most-often identified problems include significant fragmentation of agriculture, agrarian overpopulation and hidden unemployment, depopulation of peripheral rural areas and population ageing (Wesołowska, 2013). In order to counter those negative effects of socio-economic changes, the Lubelskie Voivodeship is showing increasingly visible non-agricultural and semi-agricultural functions of the countryside related to the local natural, social and economic potential (Flaga, Wesołowska, 2015). As follows from the analysis (Województwo..., 2011), total energy resources were identified as one of the three groups of development potentials for the region. The high share of agricultural land in the total area of the voivodeship (10 percentage points – p.p. – higher than in Poland and 30 p.p. higher than in Europe) translates into the remarkable popularity of agricultural biomass as an energy source. Its annual energy potential is estimated at around 18.8 PJ, which is ca. 10% of the national potential. The primary resources used to produce biomass in agriculture are: energy crops (e.g. maize and rape) and organic waste from agricultural production. The growing popularity of energy crops shows e.g. in the fact that the reserves of land which may be used for cultivating energy crops are estimated at ca. 152,000 ha (10% of the voivodeship's agricultural land) (Program...2009).

*Fig. 1. Proposed projects for the utilisation of biomass for energy purposes*



Source: Own elaboration on the basis of *The analysis of the potential of renewable energy... (2011)*

**Fig. 2. Differences between the proposed investments in the use of agricultural biomass, types of jobs created and the capacity of the proposed biogas installations, by poviát**



Source: Own elaboration on the basis of *The analysis of the potential of renewable energy...*(2011)

With respect to the role played by the development of the renewable energy sector in creating the economic potential of the region, the research consulted the study [energetycznikreatorzyzmian.pl](http://energetycznikreatorzyzmian.pl) (2012) (*Energy Changemakers*) dealing with the opportunities for the development of bioenergy based on resources from the agricultural and food sector in the Lubelskie Voivodeship. The analysed project proposed over 220 investments to utilise biomass for energy purposes located in 135 communes (LAU 2) of the voivodeship (two thirds of all communes) (Fig. 1). Were only 1/3 of them to be implemented, it would cause the voivodeship to specialise in bioenergy. Until now, four such facilities have been completed in the Lubelskie Voivodeship, and two are under construction. The study indicated chief methods of utilising agricultural production for energy purposes: the development of agricultural biogas plants, as well as agricultural and waste biogas plants, including small (up to 0.5 MW – 48 facilities), medium (0.5 to 1 MW – 12 facilities), and large facilities (above 1 MW – 7 facilities). The opportunity to generate ecological heat based on agricultural production is extremely important for the functional diversification of agriculture, but also the high quality of life of the region's residents. These purposes are served by a number of investments (almost 41% of the proposed ventures) which aim to replace coal-fired boilers with biomass boilers or old heating equipment with new more efficient one, also using agricultural fuel. These activities are also expressed in the contemplated plants processing straw and other solid by-products of agricultural production into heating products. The forecast investments in the production and use of biomass in the Lubelskie Voivodeship (Fig. 2) are of a comprehensive and exhaustive nature. If they were to be implemented, it would not only increase the energy security of the region (40 MW of energy in biogas plants); what is highly important is that it would also create jobs directly related to the operation of the investments for 770 people, and indirectly in construction, repairs and ancillary activities for 970 people. A major barrier to the implementation of the said project is money (next to the current energy policy, see Chodkowska-Miszczuk, et al., 2017). The cost of the planned investments is estimated at above PLN 670 million. The largest expenditure (76% of the sum total) is related to biogas investments, followed by biomass processing plants taking up 17%; the replacement of coal-fired boilers would be the least costly (7%). Despite all the investment costs, biogas projects are the most desired because they generate multiplier effects: they increase the number of new jobs related to the implementation of the project by 32%, as compared to other investments types. Each PLN million spent on the construction and utilisation of a biogas plant should contribute to the creation of more than one workplace. The largest number of investments related to the use of biomass are proposed by the project's experts in the

bialski and zamojski powiats (LAU 1) – northern and southern part of the voivodeship, respectively (Fig. 2). The project suggests limiting the number of modernised biomass boiler rooms in favour of establishing facilities processing straw and wood into heating products.

### 3.2 Socio-economic benefits of the operation of energy enterprises – case studies

The benefits generated by energy enterprises at the construction stage are most vivid in the case of large wind investments. The construction of the wind power plant in Postolin (Pomorskie Voivodeship), comprising 17 wind turbines with a 2 MW capacity each, resulted in jobs for around 30 people. When this undertaking was implemented, it gave rise primarily to conventional economic benefits (see Munday et al., 2011), including the use of local workforce, cooperation with local companies and profit from land rental. Due to the scope of the specialised work, a number of professionals from different parts of Poland were employed during the investment stage. The local community contributed mainly with electricians, up to 20 people at the same time. The construction and installation works lasted for almost a year, and during this time the incoming employees lived near the venue of the investment, what allowed the local population to obtain additional sources of income from services related to rental. When the wind power plant was launched, the number of employees was reduced because the installation's operational phase only requires ad hoc work of a technician. The operation of the wind turbines is supervised by a specialised company whose employees are responsible for inspecting the wind power plant, carrying out works aimed to increase the efficiency of the turbines, as well as performing diagnostics and removing current defects. The company's service centre is located in Grudziądz, at a distance of almost 60 km from Postolin.

Apart from utilising the workforce, the investor also established relationships with local businesses. For instance, it co-operated with a nearby sand mine, a company from Dzierzgoń (at ca. 25 km from Postolin) laying foundations for the wind turbines, as well as a company from Susz (a town located within around 45 km from Postolin) tasked with building all the access roads in the wind farm and modernising local roads which were destroyed during the transport of wind turbine elements. During the operational phase of the wind power plant, the Susz-based company is also servicing roads and platforms near the wind turbines. It repaired a total of ca. 5.5 km of local dirt roads and 2.5 km of asphalt roads, built a new bridge on the local river and repaired an existing one. Additionally, the investor leased plots from land owners, primarily farmers, for all energy infrastructure, including a high-voltage line, connecting the wind farm with the substation in the town of Sztum, a total length of around 9 km. This allows energy to be fed into the national power grid. Another benefit resulting from the presence of a wind power plant in a given area consists in educational and promotional activities with respect to sustainable development and ecology. One of the expressions of this type of undertakings is the campaign to plant over 200 trees within the Sztum commune, where Postolin and the wind power plant lie.

The second company selected for detailed research is the 1.4 MW photovoltaic farm in Bordziłówka (Lubelskie Voivodeship). The main benefits of the operation of a photovoltaic power plant include conventional economic benefits, such as real property tax inflows to the budget of the commune where the plant is located (commune of Rossosz), and the use of local workforce. Two people have been permanently employed in the plant: the president of the company's management board and the accountant. They are employed on the basis of a contract of mandate. The employees live 3 km and 5 km from the power plant, respectively, they both hold a university degree. The president of the board is responsible for the whole activity of the company established by the local authorities of five neighbouring rural communes, the on-going monitoring of the power plant's operation, matters related to the project's co-financing, and small technical and maintenance issues. The accountant deals with the whole sphere of bookkeeping. The company hires a local farmer for casual lawn mowing (properly prepared surface is a condition for the effective functioning of the photovoltaic modules), the man is employed on a contract for a specific work. There are 2-3 such contracts each year. The operations of the company and the power plant do not require more employees due to the almost maintenance-free functioning of the farm. During the construction of the farm, the works related to installing

monitoring, fencing, some of the earth works, securing the area were done by local companies based in the region.

There are some other clearly visible benefits arising from the operation of the photovoltaic farm, predominantly related to the educational and promotional activity. The local population is satisfied with the emergence of the photovoltaic power plant (first in the Lubelskie Voivodeship and one of the largest in Poland), primarily due to its positive impact on the environment and the promotion of the Zielawa Valley region (the name of the area where the analysed power station is located) as an unscathed place for leisure and tourist activities. The benefits that accrue from the construction and functioning of the photovoltaic power plant are surely: the positive impact on the quality of the local environment and, crucially, the increased ecological awareness of people residing in communes located not solely in the Zielawa Valley region. It is not without merit that other investors are tempted to locate their power plants in an area with a local government so positive about renewable sources. Owing to the welcoming approach of the local authorities, two photovoltaic farms and an agricultural biogas plant have been established within the Rossosz commune area, all by external investors. The company is very keen to receive groups interested in the functioning of the enterprise and the power plant. During little over two years of its existence, the power plant has been visited by around 50 groups representing schools, universities, scholars, local government officials, decided and prospective investors, employee groups from the energy sector.

Conventional benefits from the development on renewable energy in rural areas, expressed in the creation of additional jobs in rural areas, are most visible in the case of the 0.999 MW agricultural biogas plant in Działyń (Wielkopolskie Voivodship). The analysed company employs five people: the biogas plant manager, the administrative assistant and three people as biogas plant operators, including one person employed full time and two on an ad hoc basis. The company manager holds a university degree in law, and comes from Poznań which is within a distance of around 55 km from Działyń (where the biogas plant is located). The administrative matters are handled by a woman also holding a university degree and living in Gniezno (12 km away, the capital of the powiat where the biogas plant is located). The people tasked with operating the biogas plant live in the nearby localities. They e.g. handle the heating and gas installations and maintenance. It is notable that the persons working on an ad hoc basis (normally on weekends and holidays) are also employed by Działpol, a farm established in 2000 as a result of transforming a former state agricultural farm (PGR) in Działyń. Działpol covers an area of ca. 1500 ha of agricultural land and deals in livestock production, primarily milk, and production of plants, including: rape, cereals and maize ([http://dzialpol.pl/about\\_onas.html](http://dzialpol.pl/about_onas.html)). The Działyń biogas plant is a subsidiary of Działpol sp. z o.o. and is inextricably bound with that company, not only through the exchange of employees, but also through the supply of substrates for the production of biogas and the collection of digestate as fertiliser used in agricultural activity of the farm, as well as the joint use of the administrative buildings.

With reference to other socio-economic benefits resulting from the operation of the agricultural biogas plant in Działyń, the relationship between the company's owners and the local residents should be noted. The investors wish to have good relations with the local community. The biogas plant manager says: *"I've had no doubts about us functioning in the local community and we have always tried to form partner relations with it."* Relationships between the owners of the biogas plant and the local community are formed with relative ease due to the prior presence of the Działpol farm in the area. Entrepreneurs related to the biogas investment are supporting public services at the local level. This is expressed in particular in providing buildings for purposes connected with the functioning of a local kindergarten. They also participate in the organisation of cyclical events initiated by the residents and local authorities. The biogas plant owners are also involved in educational and promotional activities. The company is visited by the representatives of local authorities and central government, scholars and people not directly related to the energy sector, but interested in the functioning of this modern biogas plant. Most of those consultancy and study visits took place during the investment phase, when the entrepreneurs organised trips for Działyń residents to rural areas already housing agricultural biogas plants.

## Conclusions

The concluded research proves that the establishment and operation of RES-based energy enterprises generates economic potential of rural areas. Analyses performed on a regional scale confirm that wider use of the energy potential of the Lubelskie Voivodeship, especially based on agriculture, will help drive the activity of local communities and form the basis for creating new jobs. In turn, detailed research on energy enterprises helps distinguish conventional socio-economic benefits arising from the development of renewable energy in rural areas, including new jobs and cooperation with local companies, as well as other effects, e.g. the provision of local services or educational and promotional activities. Most jobs are offered in the implementation phase of an energy investment, and in the operational phase the number of jobs depends on the type of installation. On the one hand, energy is generated almost maintenance-free in photovoltaic and wind power plants; on the other, an agricultural biogas plant requires several employees to operate properly.

Bearing in mind the social conditions underlying the development of RES businesses in rural areas, investors also take actions directed at the needs of the local community. They participate in the creation of the local technical and social infrastructure, the organisation of local events, and educational and promotional undertakings. The need for social embeddedness of business behaviour is particularly visible in the case of external investors interested in wind energy and agricultural biogas.

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