

BARRIERS FOR RENEWABLE ENERGY SOURCES DEVELOPMENT IN POLAND ON THE EXAMPLE OF WIND ENERGY

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Abstract

Development of Renewable Energy Sources (RES) is one of main priorities of energy policy in Poland. Wind energy is one of the most dynamically developing sectors within renewable energy segment. The installed capacity of wind installations in Poland in 2014 was twice as big as in 2010. Despite such a dynamic growth, wind energy sector constantly faces obstacles of various kind in its development. The article presents the current state, barriers and development perspectives of wind energy in Poland and its share in the renewable energy sources sector.

Key words: Poland, Renewable Energy Sources, wind energy, electricity

1. INTRODUCTION

Renewable Energy Sources (RES) and sustainable development have been for a long time vital elements of the European Union's policy. This was reflected in the climate-energy package, adopted by the Council of the European Union, according to which until the year 2020 the European Union will:

- reduce by 20% emission of greenhouse gases (with an option of 30% reduction, on condition that proper international agreements will be concluded in this respect) compared to the emission from the year 1990,
- increase by 20% the share of renewable energy in the final energy consumption,
- increase by 20% energy efficiency compared to projections for 2020,
- increase the share of bio-fuels in the total consumption of transport fuels, at least to 10%.

Considering the economic development of individual member states of the European Union each of them has been set an individual goal with reference to the RES. For Poland the goal is to achieve a 15% share of energy coming from renewable energy sources in the total energy consumption in the country.

The need to implement the climate-energy package and the awareness as to the ecological and social benefits and the growth in energy security of the country or regions, have been the main incentives of a dynamic development of the RES sector in the European Union, including Poland. In the years 2004 - 2012 in the EU-28 member states each year (except for 2011) a growth in the amount of energy obtained from renewable energy sources was recorded. The growth was the highest for the EU-28 in the year 2010 and amounted 11,8% compared to the previous year, and for Poland it was the highest in 2012 - 13,7% (*Energia ze źródeł odnawialnych w 2013 roku* 2014).

Despite a substantial growth of the share of energy coming from renewable resources in the total energy balance of the country, development of the RES in Poland is conditioned by a number of barriers, which can be classified as four groups: economic barriers, environmental barriers, social barriers and legal barriers.

The goal of this analysis is to present the situation in the scope of obtaining energy from renewable sources in Poland with particular stress on wind energy and discussing the barriers connected with this RES sector functioning as well as presenting perspectives of its development.

2. WIND ENERGY IN POLAND

In Poland a dynamic development of renewable energy sources began after Poland joined the European Union in 2004. Since then, each year one can observe an increase in production of electricity coming from renewable sources (Figure 1), the share of this energy in the total electricity production has been growing as well, which can be observed in Figure 2.

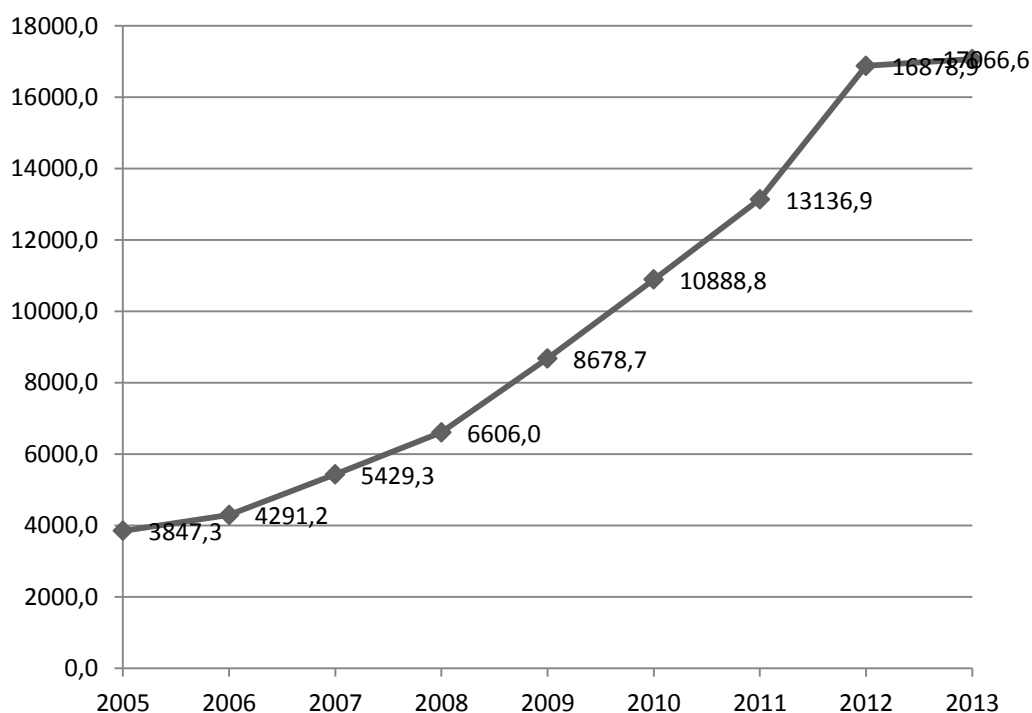


Figure 1. Production of electricity from renewable energy sources (in GWh) in Poland in the years 2005-2013

Source: Own analysis on the basis of data by Central Statistical Office

In the analyzed period production of electricity coming from RES grew from the level of 3847,3 GWh in 2005 to the level of 17 066,6 GWh in 2013, which means a growth of over three times in the analyzed period. The average dynamism of electricity production in the analyzed years amounted about 20.5 %.

The growth of the production of electricity coming from the RES was accompanied by its growing meaning in the production of electricity in Poland.

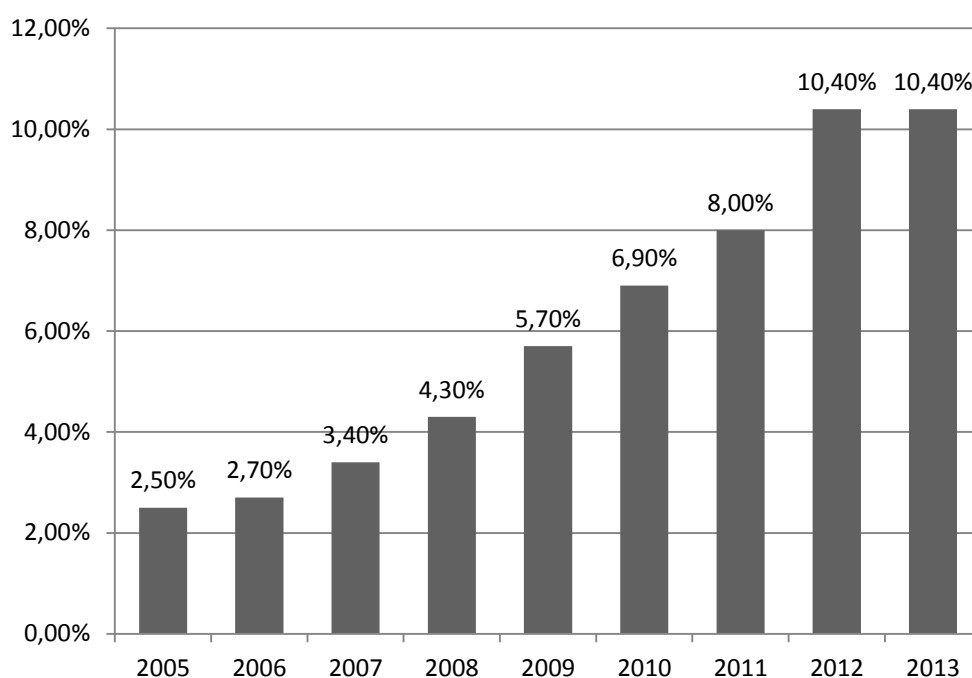


Figure 2. Share of renewable energy in total electricity production in the years 2005-2013

Source: Own analysis on the basis of data by Central Statistical Office

In the year 2005 the share of renewable energy in production of electricity in Poland amounted only 2.5%, and in the year 2012 it reached the level of 10.4%. Dynamic development of installations making the use of renewable energy sources allows us to be optimistic about the future, and what follows, it seems realistic that Poland will be able to achieve by 2015 the assumed level of 15% share of energy coming from renewable sources in the total energy consumption in the country.

Despite the clear growth of importance of RES in electricity production in Poland the leading role in its production play power stations using the coal technologies. Figure 3 presents the share of particular energy carriers in electricity production in Poland in the years 2009-2012.

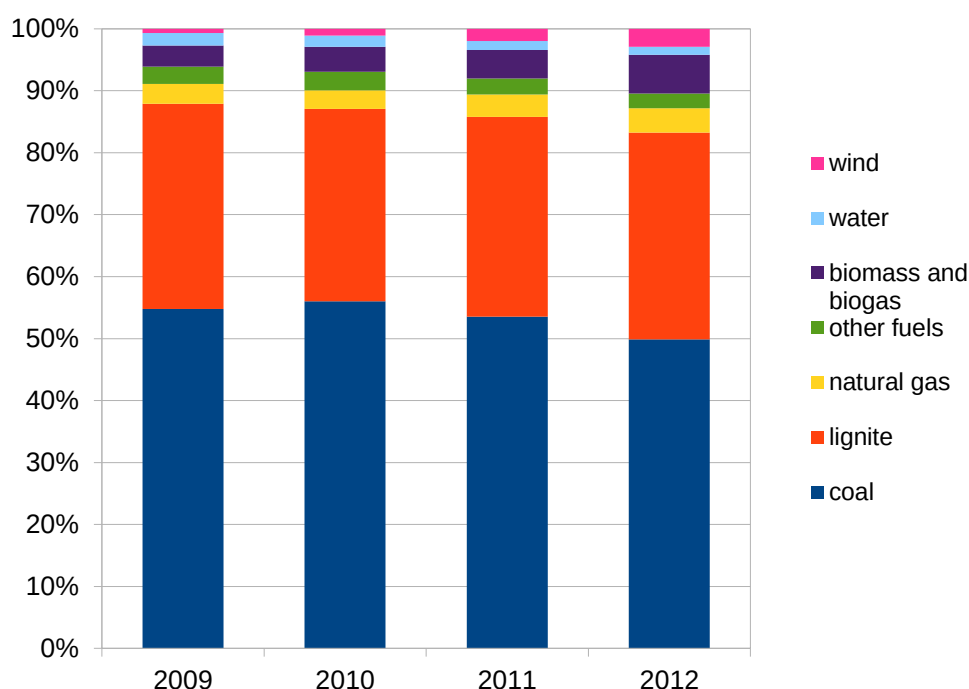


Figure 3. Share of particular energy carriers in electricity production in Poland for the years 2009-2012

Source: Own analysis on the basis of data of the Energy Market Agency "Statistics of Polish Electro-Energy Sector"

The biggest share in production of electricity in Poland belongs to coal power stations, respectively over 50% the ones using hard coal and over 30% the ones using lignite based technologies. At the turn of those analyzed years the share of hard coal in electricity production decreased by 5% while the importance of renewable energy grew, in particular of the energy coming from biogases and biomass and wind energy. These two carriers of renewable energy sources play the most important role in the production of "green energy" in Poland.

It should be stressed that the big share of biomass in electricity production in Poland results from the fact of its use in the process of co-incineration. Moreover, this production and then the energy use of biomass contributes to limitation of capital outflow from particular countries and regions. It is worth noticing here the role that the energy crops play in diversification of agricultural activity. The advantages of energy crops include: low investment costs connected with production, processing and direct incineration of such type of biomass and environmental effects, including development of agricultural areas of lower quality, class of agricultural land (Chodakowska- Mischuk & Szymańska 2012).

Apart from the biomass the renewable source which is currently growing in importance is wind energy. It is wind energy that constitutes the fastest developing sector of energy technologies and is one of most profitable renewable energy sources (Chan & Blaabjerg 2009).

In the years 2005 - 2014 the capacity of installed in Poland wind power stations grew from 83, 28 MW in 2005 to the level of 833,83 MW in 2014. (Figure 4). This means that the capacity of wind power stations in Poland in the period of the last 10 years has grown over 46 times.

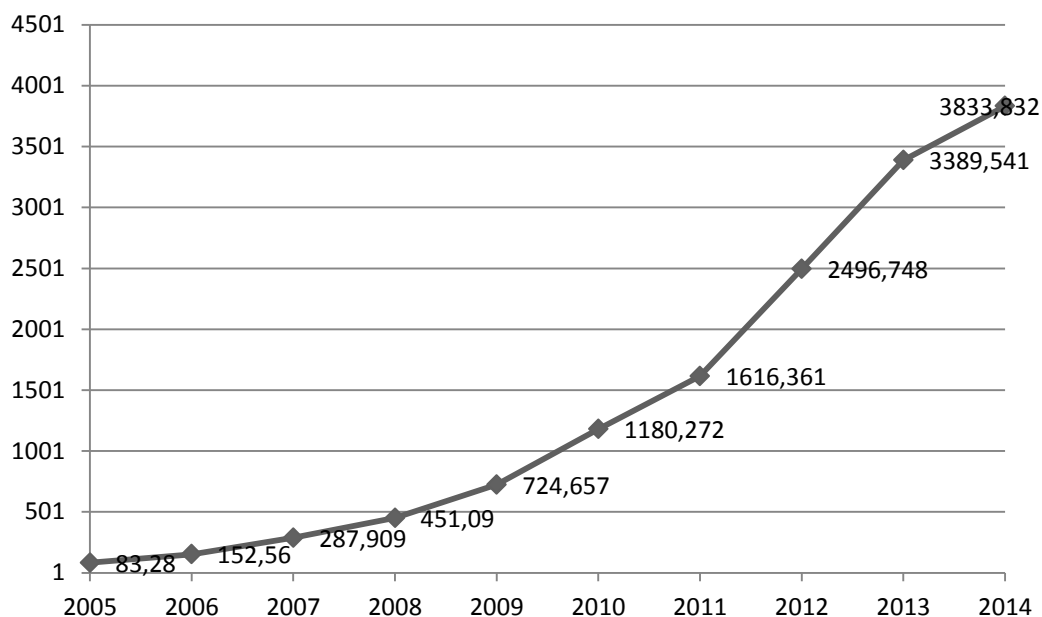


Figure 4. Growth of the installed capacity of wind power stations in the years 2005-2014 [MW]

Source: Own analysis on the basis of data of the Polish Energy Regulatory Office

In the years 2005-2014 the installed capacity of wind power stations increased annually on average by 53%. Despite such a dynamic wind energy development in Poland experts agree that wind energy has a high economic and market potential in Poland, the use of which is definitely not satisfactory. In the year 2020 wind energy could satisfy 25% of electricity demand at the demand on the level of 131 TWh. Continuation of this trend would enable the share of wind energy in total electricity to grow to almost 45% (*Wizja rozwoju energetyki wiatrowej w Polsce do 2020 roku* 2009).

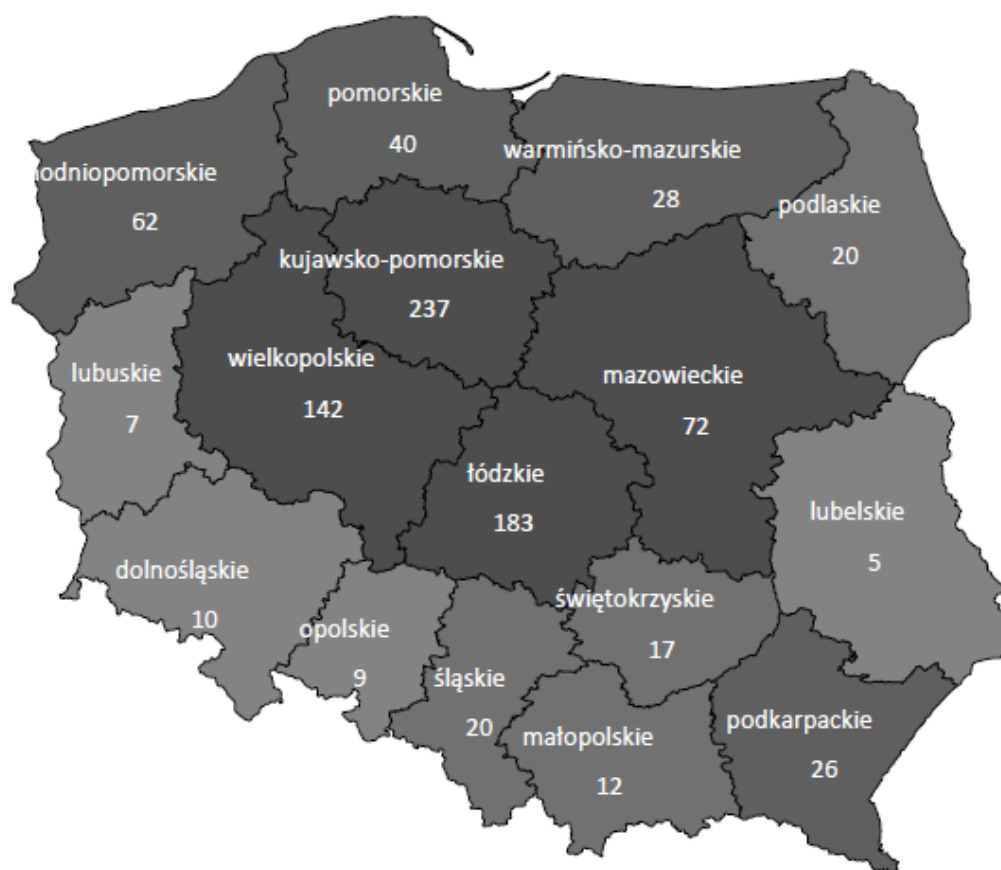


Figure 5. Number of wind installations in particular voivodeships in Poland (at 30 June 2014)
Source: Own elaboration on the basis of data by the Polish Energy Regulatory Office

The data of the Polish Energy Regulatory Office shows that at the end of June 2014 there were 890 wind installations functioning in Poland (a wind installation is both a single windmill and a wind farm, it is estimated that currently there are more than 2000 wind turbines of various capacity), the capacity of which amounted 3726,3 MW, and the growth of their capacity influenced the growth of obtained energy. Spatial distribution of wind installations and their installed capacity in particular regions of Poland present Figure 5 and 6.

The biggest number of wind installations is located in the following voivodeships: Kujawsko-Pomorskie, Łódzkie, Wielkopolskie, Mazowieckie and Zachodniopomorskie. This localization of wind power stations is influenced by both wind conditions in particular regions of Poland as well as economic factors connected with economic development of individual voivodeships, and what follows investment potential of economic subjects functioning in them.

Although wind conditions in Poland have not been examined and recorded precisely enough, according to the research by Polish Association of Wind Energy investments connected with wind energy sector may be conducted on almost 29,8% of the area of Poland and 8,9% of the area of our country has favourable, and 1,4% very favourable conditions for their localization. In the coastal strip the conditions are similar to those in Denmark, and in Central Poland wind resources are not different from those in Germany. Particularly favourable conditions occur on the coast of the Baltic Sea (from Koszalin to Hel), on the Uznam Island and in the north-east Poland (Suwalszczyzna). Good conditions occur in Beskid Żywiecki and Bieszczady (*Zielona energia* 2011).

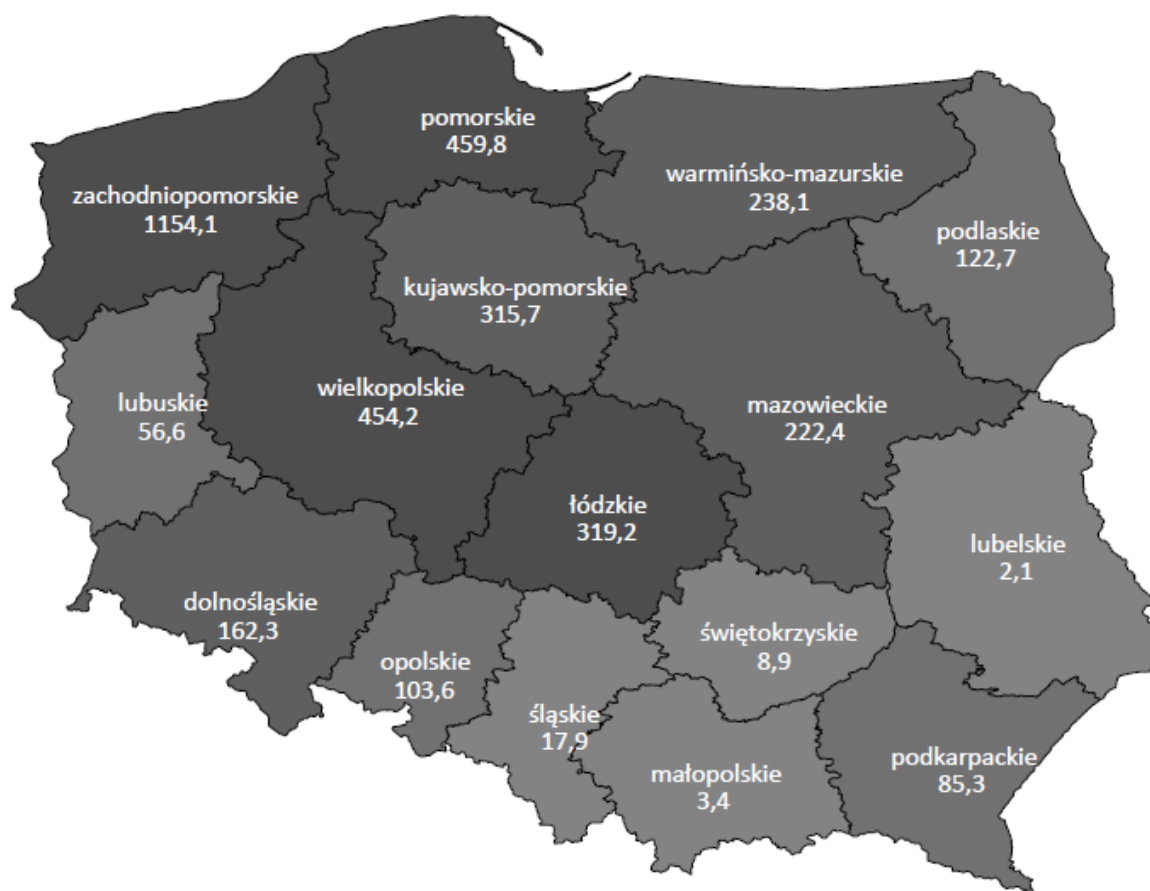


Figure 6. Installed capacity of wind installations in particular voivodeships in Poland (at 30 June 2014)

Source: Own elaboration on the basis of data by the Polish Energy Regulatory Office

As it has been mentioned earlier the installed capacity of wind power stations in Poland in the last 10 years has increased more than 40 times. The voivodeships in which the capacity of wind installations is the highest are the following ones: Zachodniopomorskie, Pomorskie and Wielkopolskie. Although in the first two voivodeships the number of installations is not the biggest in the country they are characterized by high capacity and largely they function as big wind farms not as single installations. The regions of the smallest capacity of installed wind installations are the voivodeships: Lubelskie, Małopolskie and Świętokrzyskie.

3. BARRIERS FOR WIND ENERGY DEVELOPMENT IN POLAND

Despite a large development potential and numerous benefits which wind energy brings for the environment, society and economy the increase of the wind energy share in Polish energy mix still faces various barriers, which include (Soliński, Soliński & Ranzos 2007):

- technical-economic barriers,
- localization-infrastructure barriers,
- energy-network barriers
- administrative barriers,
- social barriers,

- financial barriers,
- legal barriers,
- information-educational barriers
- geographical barriers.

In the survey directed at specialists who are involved in investments in the wind energy sector and the investors themselves the respondents indicated the following barriers of wind power stations development in Poland (*Raport bariery rozwoju energetyki wiatrowej, ze szczególnym uwzględnieniem aspektów akceptacji społecznej* 2013) (barriers ordered chronologically from the most to the least important ones):

- no law on renewable energy sources,
- complicated procedures and long time needed to obtain required permissions,
- weak law – concerning e.g. land-use planning,
- lack of mechanisms enabling predicting long-term prices of electricity sale,
- lack of political will to support wind energy,
- insufficient inclusion of wind energy development in the energy policy and development,
- conflicts with local communities,
- lack of developed methods of avoiding conflicts with ecological groups,
- insufficient possibilities of obtaining support from ecological funds of the European Union,
- high initial investment expenditures connected with expensive technologies,
- relatively high cost of wind energy production compared to the conventional energy.

A synthetic grasp of the factors impeding development and functioning of wind energy in Poland is presented by Kassenberg, who indicates five key barriers, which are (Kassenberg 2012):

- Lack of law on renewable energy sources - as a consequence conditions of implementing investments are frequently changed, investors are not sure that the conditions in which they will have to function will be the same as the ones on which they based their business plans,
- Duration of administrative procedures - investors are discouraged by long-lasting administrative procedures, often the time from submitting an application to issue an environmental decision to obtaining it is more than two years. The average time of waiting for the conditions of connecting a new installation to the network is up to 6 months. It should be noticed here that the whole process of completing an investment in some cases takes even 5 years.
- Bad condition of energy networks causes that new investments face very strict prognosis conditions of supplying energy to the network, there are also no mechanisms of balancing the capacity of wind power stations network located in different areas.
- Lack of political will to support the development of RES. In Poland there is a powerful lobby supporting conventional coal based energy. It is created by both trade unions as well as politicians who belong to boards of enterprises connected with energy based on conventional sources. Moreover, local governments being under a strong influence of local communities are also not interested in wind energy due to the fact that the topic often causes protests on the side of local community or ecologists.
- Low level of ecological awareness of Polish society and low level of knowledge on modern technologies.

In the discussion concerning the barriers of development of investments in the scope of renewable energy sources Koszarek-Cyra indicates four groups of factors limiting this development (Koszarek-Cyra 2014):

- economic ones,
- environmental ones,
- social ones,
- legal ones.

Economic barriers of wind energy development are mainly connected with the high cost of purchasing technologies at a relatively long time of return on the investment. Moreover, in case of financing the investments from external sources, either in the form of a loan, or various subsidies, investors cannot expect reliefs or simplified procedures. Institutions financing projects or granting investment loans still apply standard risk evaluation procedures, which do not take into consideration additional values such as social and environmental value or influence on country's energy security (Krystosiak 2012).

The most frequently mentioned threats to natural environment connected with wind energy are the following (Soliński, Soliński & Solińska 2008):

- noise emission and vibrations connected with wind turbine work,
- areas and species to the natural landscape of technical elements making the landscape value worse,
- possible migration of animals from the areas where the power stations are situated,
- threats for birds resulting from the possibility of hitting the spinning propellers of the power station,
- stroboscope effect (flickering).

The presented threats are particularly stressed in case if the investment is located in the direct neighbourhood of areas or species protected by law. This concerns in particular national parks, landscape parks, nature reserves and areas protected under the system Nature 2000. The last form, which has been functioning for a short time, is most troublesome for investors, mainly because the borders of its areas have not been definitively defined and its range comprises only 21% of the area of Poland.

Another example of a barrier to the wind energy development is the social element in the process of agreeing the investment, and resulting from the cumulative effect. Social consultations concerning localization of wind farms are frequently required at this stage. This happens if the permission to realize the investment is conditioned by obtaining so called decision on outline planning and spatial development or if it is necessary to introduce changes to the Local Outline Planning and Spatial Development. Opponents of the RES quote a number of arguments proving how harmful such investments are. In case of wind power stations the most frequently mentioned ones refer to nuisance caused by noise and vibrations created by wind turbines, which can lead to the development of vibro-acoustic illnesses. Moreover, a risk of propellers falling off, icicles falling down from them in winter and the possibility of attracting atmospheric discharges in the form of lightning by high installations of wind power stations are indicated. Local communities are often supported in their protests by ecological organizations, the main goal of which is preventing investments in wind energy. One of the best-known organizations of this type in Poland is the association "Stop windmills".

Very often objections of local communities to build wind power stations are used by politicians of the local level (municipality, county) to create political capital.

One of the most important barriers of wind energy development in Poland are legal limitations concerning investments into RES and this energy sector functioning. As it has already been mentioned the RES sector functioned in Poland till the end of the year 2014 without a law on renewable energy sources. Functioning of this sector was only regulated in the law called Energy Law, which did not

comprise all aspects of its functioning in Poland. Presently, the biggest barrier to wind energy development in Poland is inaccuracy of legal basis which are used while preparing and implementing the investment. Particularly stressed here should be the principles of connecting the investment into the country's electro-energy system, principles of investment's influence on environment evaluations and all agreements of social nature.

The basic problem encountered by investors in rural communes where investments are implemented is lack of local spatial development plans (or lack of energy-related issues in the existing ones), which results in the necessity to conduct a prolonged planning process. Preparing and accepting a local spatial development plan is one of the longest lasting parts in the cycle of project development (it takes about 2 years).

Another barrier in the process of preparing an investment connected with construction of a wind power station is the procedure of issuing environmental decisions on conditions of implementing an investment and requirements of the bodies involve in issuing such decisions. There are no official guidelines (despite proposals of independent organizations in this scope) with regard to the evaluation of the RES technologies impact on environment. This often results in unjustified requirements of the bodies issuing decisions, which has a significant influence on the investment profitability and increases its risk (*Lista barier w sektorze energetycznym* 2011).

The above presented barriers may be recognized as a basic limitation to wind energy development in Poland. Without a change of political attitude to RES, noticing the benefits resulting from their application and knowledge that these are solutions supporting innovativeness and sustainable development, the potential of renewable energy sector in Poland will not be fully used.

4. SUMMARY AND INDICATION OF INDISPENSIBLE MEASURES IN THE SCOPE OF WIND ENERGY DEVELOPMENT IN POLAND

Conducted in the article analyses of statistical data connected with functioning of wind power stations in Poland and barriers that have an influence on this sector of renewable energy sources allow us to formulate the following conclusions:

1. Wind energy is this sector of RES in Poland which is characterize by the highest developmental potential, with an average development rate of the installed capacity of wind power stations on the level of 53% in the years 2005-2014.
2. Majority of the installed capacity in wind turbines is located in the coastal area, in the following voivodeships: Zachodniopomorskie and Pomorskie and also in Wielkopolskie Voivodeship.
3. The factor which impedes development of this energy domain is bad condition of electro-energy networks in Poland, especially the ones of medium voltage, which generates high costs of including wind turbines to the network. Moreover, development of electro-energy infrastructure does not meet the needs of dispersed energy producers, based on RES.
4. The barrier to wind energy development in Poland are contradictory and interpreted in different ways law regulations concerning mainly planning, construction and environmental issues. Especially vital is also the social factor connected with lack of social acceptance for building wind power stations.
5. Lack of political will to support stronger investments in the scope of RES and lack of the law on renewable energy sources in Poland are further barriers impeding development of wind energy in Poland. A major role undoubtedly plays here a strong lobby connected with the hard coal and lignite sector and power stations using these resources in energy production.

It should be assumed that wind energy in Poland will still develop and the factors that will determine its development include:

1. Adopting by the Polish Parliament on 20 February 2015 the law on renewable energy sources which comprehensively regulates functioning of this sector in Poland and indicates specific support instruments for this energy sector.
2. The segment supporting the growth of energy coming from renewable sources in energy balances should be prosumer energy (Kucęba & Bajor 2014). The new law on RES prefers prosumers, that is individuals producing energy mainly to satisfy their own needs and selling possible surpluses to the network. According to the law it is guaranteed for the owners of home installations of the 10 kW capacity that the surpluses will be bought at the price higher than the market one.
3. Fulfilling the commitments that have been imposed by so called energy and climate package, and in the further horizon also the ones resulting from new framework of policy in this scope being the effect of the arrangements of the Council of the European Union of the 24 October 2014. According to the amended climate package the share of renewable energy sources in the energy mix on the level of the whole European Union should amount 27% until the year 2030 (Włodarczyk 2014).
4. Stable, foreseen and unequivocally interpreted with regard to all investments connected with wind energy law regulations, which will improve implementation of investment processes and rationality in the process of conducting business activity.
5. Actions in the scope of improving transmission infrastructure, capable of absorbing an increased amount of energy coming from dispersed sources.

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