

DEVELOPMENT LIMITATIONS AND PERSPECTIVES OF RENEWABLE ENERGY SOURCES IN POLAND

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Abstract:

Because of deteriorating condition of the environment and more and more difficult situation on the market of energy fuels, the role of renewable energy sources is increasing. In the paper an analysis was performed on the development limitations and perspectives of renewable energy sources on the Polish market. The analysis conducted shows that the renewable energy sources start to be used in a bigger scale in Poland. It may also be noticed that the significance of the particular renewable energy sources is dynamically changing in time. In year 2005 hydropower was largely dominating among the renewable energy sources, however, in 2016 wind power was clearly prevailing. One of the most important factors determining the development of renewable energy sources in Poland are legal conditions. They were subject to analysis, taking into account the European Union regulations and Polish regulations. The research was based on literature review, analysis of legal regulations and of data coming from the reports and statistics published by the Central Statistical Office, Ministry of Energy, Ministry of Environment, Energy Regulatory Office, Fund for Environmental Protection and Water Management, and other organizations.

Key words: *renewable energy sources, environment protection, power industry in Poland*

INTRODUCTION

Recently it has been more and more discussion on the problem of greenhouse gases emission, water and soil degradation, smog and other environmental issues, the main source of which are conventional energy sources, especially coal. At the same time the situation on fuel market is getting more complicated. The price of traditional energy resources, such as coal, becomes more expensive due to the necessity of transporting them on a long distance and the mining conditions are getting harder, especially in Poland [1]. Furthermore, disturbing signals appear in terms of exhaustion of traditional resources of fuel. In the face of deteriorating condition of the environment and more and more difficult situation on the market of energy fuels, one should focus on a direction of searching for alternative energy sources, other than the conventional fuel. The objective of this paper is to analyze the development limitations and perspectives of renewable energy sources on the Polish market. The research is based on literature review and data from the reports and statistics published by the Central Statistical Office, Ministry of Energy, Ministry of Environment, Polish Energy Regulatory Office, Fund for Environmental Protection and Water Management, and other organizations.

THE TYPES OF RENEWABLE ENERGY SOURCES USED IN POLAND

The renewable energy sources are the sources using natural environmental processes, which are an alternative for the traditional, non-renewable energy carriers such as fossil fuels [2]. The installation of renewable energy source is defined, in the current state according to the Polish legal regulations, as an individual set of:

- a) appliances used for energy production and power transport, where electricity or heat are produced from renewable energy sources, or
- b) construction objects and appliances that constitute a technical and utilization entirety for the production of agricultural biogas, and also power storehouse connected to this set, including the agricultural biogas storehouse.

The definition of installation of renewable energy sources is included in the Act of 20th February 2015 on the Renewable Sources of Energy [3], next it was changed in the Act of 22nd June 2016 on Changing the Act on Renewable Sources of Energy and other acts [4].

In the Polish conditions the energy from renewable sources is produced using solar radiation (transferred into heat or electricity), wind, water, solid biomass, biogas and liquid biofuels as well as geothermal resources [5].

LEGAL CONDITIONS OF USING RENEWABLE ENERGY SOURCES IN THE EUROPEAN UNION AND IN POLAND

Legal conditions are one of the most important determinants of the development of renewable power industry. The basic significance belongs here to the increase, imposed on Poland by the EU regulations, concerning the level of electricity production from the renewable sources, at least up to 15% of total power consumption.

The main legal act describing the rules and conditions of electricity production from renewable energy sources is the Act of 10th April 1997 – Energy Law Act [6] and the regulations of Act of 20th February 2015 on Renewable Sources of Energy. The law, especially Act on Renewable Sources of Energy, was developed in order to adjust Polish law to the requirements of EU law, mainly included in the Directive 2009/28/EC of the European Parliament and of the Council of 23 April 2009 on the promotion of the use of energy from renewable sources and amending and subsequently repealing Directives 2001/77/EC and 2003/30/EC [7].

The Energy Law Act regulates the issues important from the investor's point of view, who wants to produce power from a renewable energy source. According to art. 9 of this Act, the investor is guaranteed to sale the power produced, however, the particular power enterprises are obliged to purchase this power and heat from the non-conventional and renewable resources.

The Act on Renewable Sources of Energy specifies the rights and obligations of the subject that wants to produce power or biofuel from renewable energy sources as well as the mechanisms supporting the development of renewable energy sources in Poland. The second chapter of this Act refers to micro installations and small installations. Micro installation is meant as an installation of power no higher than 40 kW, connected to power grid of rated voltage lower than 110 kV or installation of rated thermal input no higher than 120 kW. Small installation is an installation of power higher than 40 kW but not exceeding 200 kW, connected to power grid of rated voltage lower than 110 kV or installation of rated thermal input higher than 120 kW, but not exceeding 600 kW. The articles of the Act on Renewable Sources of Energy describe the rules of connecting this installations to power grid, the way of settling accounts concerning power provided and obtained to/from power grid, rights and obligations connected with electricity production. The third chapter of the Act on Renewable Sources of Energy refers to the conditions of conducting activity consisting in the production of agricultural biogas or bioliquids and production of electricity from agricultural biogas and bioliquids. The fourth chapter includes the regulations aimed at supporting the sector of renewable energy sources. It determined the maximal value of state support for the investor who produces electricity from renewable energy sources, the value of proprietary rights coming from the certificates of

origin for electricity, which can be sold on the stock market, tax reliefs and exemptions as well as support of investment and the operating character.

Although the Act on Renewable Sources of Energy is the basic indicator of the development of renewable energy sources in Poland, it is not the only source of law in this area. Additionally, of great significance are other environmental acts, that is the Act of 21st April 2001 – Environmental Protection Law [8] and the Act of 8th October 2008 on Environmental Information and its Protection, Public Participation in Environment Protection and on Environmental Impact Assessments [9]. Moreover, in terms of renewable energy source from wind the Act of 20th May 2015 on Investment in Wind Power Plants [10].

THE RANGE OF UTILIZATION OF RENEWABLE ENERGY SOURCES IN POLAND IN YEARS 2005-2017

The state energy policy, having its reflection in the aforementioned legal regulations, is directed at supporting the development of renewable energy sector. The effects of this policy become more and more visible. The production of electricity from renewable energy sources in years 2005-2017 is successively increasing [11]. In 2005 it was about 3.7m MWh, in 2010 it exceeded 10m MWh, and in 2016 it went over 20m MWh. As for this moment, data of the fourth quarter 2017 have not been published yet, therefore these data cannot be directly compared with the previous years. For illustrative purposes, the data for the three quarters of 2017 have been adopted, however, final conclusions for that year can be drawn after its closure and report publishing. Taking into account the three quarters of 2017, it may be noticed that the dynamics of increment of the utilization of some renewable sources clearly slowed down (Table 1 and 2).

The most dynamically developing RES sector was the sector using energy from solar radiation for electricity production [12]. This renewable energy source has not been used until 2008. In 2009 first installations appeared, however, their share in the total electricity production from RES was scarce (1.3-1.7 MWh yearly, in the view of total production from RES amounting to about 8.6-10.9m MWh). In year 2011 a very high rise of energy produced from this source occurred, over a hundred times, in the subsequent year another dynamic increase – about 6 times. In the next years further rises were noted although not so spectacular ones. Another crucial moment was in 2015, when the energy produced from this source increased by almost 10 times. Despite such dynamic development, the share of installations using solar radiation in the total energy production from renewable sources is still low. In 2016 it accounted for about 0.2%. It should be emphasized that the data include only the installations having an important participation in energy production and do not include the disperse (backyard) installations, providing low quantities of energy for the needs of private users [13].

Table 1
The amount of electricity produced from renewable energy sources (RES) in years 2005-2017, confirmed by the certificates of origin issued by the president of Energy Regulatory Office [MWh]

Type of RES installation	2005	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017(three quarters)
Installations using biogas	104 465.3	116 691.9	161 767.9	220 882.9	295 311.8	363 595.7	430 537.3	529 384.4	665 143.2	803 125.5	874 062.4	1 000 321.1	573 404.9
Installations using biomass	467 975.7	503 846.2	545 764.9	560 967.4	601 088.2	635 634.8	1 101 189.0	2 208 508.1	3 846 121.8	5 615 077.4	4 714 688.3	4 573 976.2	257 806.7
Installations using energy from solar radiation	0.0	0.0	0.0	0.0	1.3	1.7	177.8	1 177.5	1 418.8	4 514.9	42 907.8	80 304.1	38 710.2
Installations using wind power	135 291.6	257 037.4	472 116.4	806 318.6	1 045 166.2	1 823 297.1	3 128 672.5	4 612 893.8	6 078 433.9	7 640 802.1	10 685 600.8	12 453 726.1	7 992 274.4
Installations using hydropower	2 175 559.1	2 029 635.6	2 252 659.3	2 152 943.2	2 375 778.8	2 922 051.6	2 316 833.4	2 031 724.6	2 439 275.0	2 181 135.8	1 828 657.3	779 373.6	440 953.2
Installations using the technology of co-combustion of biomass, biofuels, biogas or agricultural biogas with other fuels	877 009.3	1 314 336.6	1 797 217.1	2 751 954.1	4 287 815.4	5 243 251.4	5 999 582.1	6 714 155.7	3 751 860.2	4 462 167.7	4 260 440.6	1 182 751.1	229 319.8
Total	3 760 301.0	4 221 547.7	5 229 525.7	6 493 066.2	8 605 161.8	10 987 832.4	12 976 992.0	16 097 844.2	16 782 252.9	20 706 823.4	22 406 357.1	20 070 452.2	9 532 469.2

Source: Reports of Energy Regulatory Office.

Table 2
The dynamics (year/year) of electricity produced from RES in years 2006-2017, confirmed by the certificates of origin issued by the president of Energy Regulatory Office [%]

Type of RES installation	2006	2007	2008	2009	2010	2011	2012	2013	2014	2015	2016	2017(three quarters)
Installations using biogas	111.7	138.6	136.5	133.7	123.1	118.4	123.0	125.6	120.7	108.8	114.4	57.3
Installations using biomass	107.7	108.3	102.8	107.2	105.7	173.2	200.6	174.2	146.0	84.0	97.0	5.6
Installations using energy from solar radiation					125.9	10 634.3	662.3	120.5	318.2	950.4	187.2	48.2
Installations using wind power	190.0	183.7	170.8	129.6	174.5	171.6	147.4	131.8	125.7	139.8	116.5	64.2
Installations using hydropower	93.3	111.0	95.6	110.4	123.0	79.3	87.7	120.1	89.4	83.8	42.6	56.6
Installations using the technology of co-combustion of biomass, biofuels, biogas or agricultural biogas with other fuels	149.9	136.7	153.1	155.8	122.3	114.4	111.9	55.9	118.9	95.5	27.8	19.4
Total	112.3	123.9	124.2	132.5	127.7	118.1	124.0	104.3	123.4	108.2	89.6	47.5

Source: Own work based on reports of Energy Regulatory Office.

The attention should also be paid to the change in the sources structure of producing energy from RES in the view of the analyzed years (see Figure 1). In 2005 this structure was dominated by the installations using hydropower. At that time they produced 58% of energy coming from renewable sources. Up to 2014 the level of production from this source remained quite stable and amounted yearly in average to about 2.3m MWh. Nevertheless, as a consequence of a dynamic development of installations using other renewable sources, the share of hydropower decreased considerably in the energy balance coming from RES. In year 2014 it only amounted to 11%. In the subsequent years of analysis the share of energy production from RES continued to fall, but for the first time in the analyzed period it was accompanied by a visible drop of energy produced from this source – in year 2015 to the level below 2m MWh, and in 2016 below 1m MWh. After the first three quarters of 2017 it may be assumed that the decreasing trend observed in the recent years will advance in case of hydropower [14].

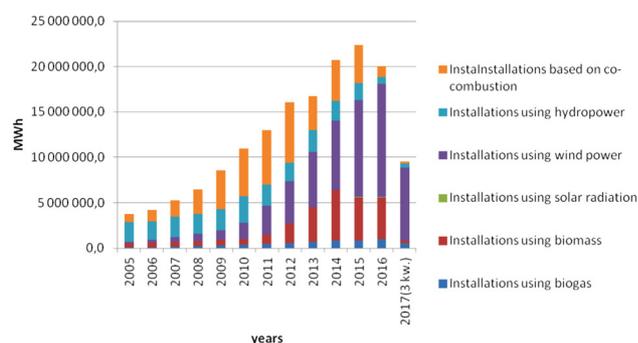


Fig. 1. The structure of sources of energy production from renewable sources

Source: Own work based on reports of Energy Regulatory Office.

The place of a decreasing share of hydropower in the balance of energy produced from RES, in the first years of analysis, was taken by the share of energy produced from the installation using the technology of co-combustion of biomass, bioliquids, biogas or agricultural biogas with other fuels [15, 16]. In year 2005, using this type of installations, 23% of energy coming from RES was produced. In year 2009 it was as much as 50%. The pace of increase of energy production from this source clearly slowed down from year 2010 and since that moment its share in the

balance of energy produced from RES also decreased. The largest drops of energy production from this source may be noticed in the last years of the analyzed period. In year 2016 the share of installations using the technology of co-combustion of biomass, bioliquids, biogas or agricultural biogas with other fuels in the balance of energy produced from RES amounted to about 6% only.

In the last years of the analyzed period the share of wind power in the energy produced from RES is more and more distinct. The installations using wind power at the beginning of the examined period (in 2005) provided only 4% of energy coming from RES, however, in year 2016 it was over 60% of this energy.

A significant role in the balance of energy produced from RES also belongs to biomass [17] [18]. In 2005 about 12% of this energy came from this source, furthermore, in 2016 about 23%. In turn, biogas [19], not including energy coming from solar radiation, constitutes the lowest part of the structure of energy production from RES. Its share fluctuates in the range 3-6%.

CONCLUSIONS

It stems from the data presented that the significance of the particular renewable energy sources is dynamically changing in time. In year 2005 among these sources the utilization of hydropower dominated (58% of energy from RES was produced in hydropower plants), however, in year 2016 wind power was clearly prevailing (62% of energy from RES was produced by so called windfarms). In the whole examined period the share of energy coming from solar radiation also stands out, though very big dynamics of increment of energy produced from this source allows claiming that it will take an important place among RES in the near future. The sun constitutes the source of clear and inexhaustible energy and its amount transported to Earth in one hour is higher than the yearly consumption of energy of all people in the world. Nevertheless, it should be emphasized that the current installations using the energy from solar radiation are not very effective and expensive, what causes that they are not rivals for the traditional fossil fuels. The future of solar energy sector should be connected with the improvement of quality and durability of solar collectors as well as their price decrease. Despite these type of problems, renewable energy sources are used in a greater scale. A positive assessment belongs to the increment of the total value of electricity produced in a year from RES in the period 2005-2016 from the level of almost 4m MWh in 2005 to the level of over 20m MWh in year 2016.

ACKNOWLEDGEMENTS

The paper was financed from the sources of the Silesian University of Technology, statutory work no. BK-231/ROZ1/2018 (13/010/BK_18/0029).

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