

# RENEWABLE ENERGY SOURCES AND THEIR IMPACT ON POLISH LABOR MARKET IN THE CONTEXT OF GLOBAL ENERGY PROBLEMS

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## Abstract

*The aim of this article is to analyze potential directions of Renewable Energy Sector (RES) development and its impact on the labor market: assessing job-creating potential of renewable energy sector in Poland. The paper focuses primarily on electricity generation technologies like wind power stations and solid biomass. The comparison between employment level for RES sector and other sectors shows the scale of the impact of renewable energy development on the labor market in Poland and on the country's economy overall. Our findings show that currently, the total number of jobs created because of the development of wind energy (11 500), solid biomass (18 800) and solar energy (2 750) exceeds employment in the coke industry (4 000), cement (6 000) and lignite mines (5 000). According to the author's research, the results of the study indicate that the construction of, for example, wind power plants is not only an opportunity for local communities to create additional employment, but it also provides an opportunity to enrich the community with various types of taxes.*

**Keywords:** *economic effects, labor market, renewable energy, sustainable development economy*

**JEL classification:** Q42, Q43, P48

## 1 Introduction

Energetics is the key area of industry in most countries of the world in economic, social and political context and, therefore, fuel and energy complex is under the

special supervision of the state while being quite strictly regulated. National security as a whole depends on this complex and its economic constituent elements. The increasing degree of internationalization and globalization of the energy sector and growing energy interdependence between individual countries, confirm the thesis about the countries' inability to ensure their energy security without solving problems of international energy security at regional and global levels with particular emphasis on renewable energy sources.

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 which imposed on Poland the obligation to increase the share of renewable energy in the final gross energy consumption by the end of 2020. The Directive sets new conditions for the development of renewable energy production and provides a common framework for the promotion of renewable energy sources. At the same time, it establishes mandatory national general objectives in order to create a possibility to achieve 20% share of renewable energy in the gross end-use of energy throughout the EU in 2020. The goal for Poland is to achieve a 15% renewable energy (RES) share of total final energy consumption by 2020. All those actions have a huge impact on both Polish and European labor market in general.

The purpose of the article is to analyze Polish labor market in the context of renewable energy sources development, analyzing the current state and future possibilities, as well as RES impact on regional development based on conducted study, with particular emphasis on data from Kisielice community – the only energy-independent community in Poland.

## **2 Data and Methods**

The analysis in this article is based on the study of literature, the legal regulations and Eurostat's statistics as well as on author's own paper-and-pencil interviews conducted in 2015 among a) RES investors and b) municipalities in which wind power stations are located in Poland, as well as c) in municipalities with outstanding wind conditions but no wind farms established there yet; in order to collect detailed responses and a set of qualitative data.

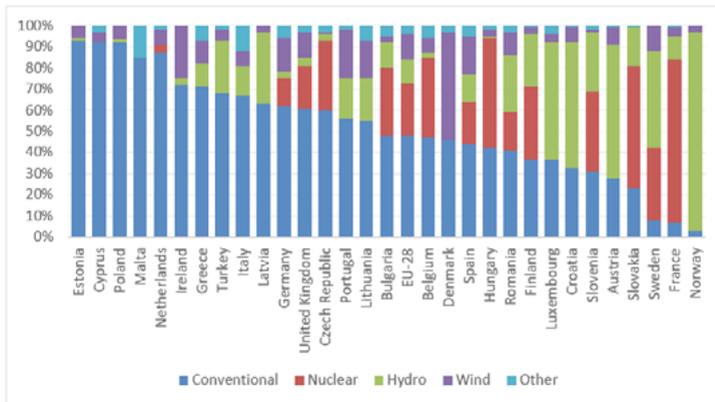
## **3 Results of the research**

National security depends on ensuring energy security in terms of diversifying not only sources of supply (using a wide range of energy sources) but also suppliers, routes and transport mechanisms. A country's energy system, based on a few

large coal power plants is more susceptible to sabotage than a system based on a dozen scattered low- and medium-power sources. The problems of Polish and EU energy dependence and employment reduction in such industries as mining can be partly solved by developing strong renewable energy sector as well as building credible partnerships with suppliers, transit countries and buyers. International solutions are also needed to reduce global greenhouse gas emissions.

The diversification of electricity sources in the EU countries by energy source is shown in figure 1. According to data presented in figure 1, Poland occupies the third place in terms of using traditional energy sources, such as coal, for electricity production. Poland's power industry has always been based on coal, that is why the largest power units were created near the coal and lignite mines.

Figure 1 EU breakdown of electricity production by source in 2016



Source: Author's own calculations based on Eurostat data.

Considering the actual conditions and effects of renewable energy sector development, it is important to take into account, in accordance with the constitutional guiding principles of environmental protection, the principle of sustainable development, economic and social factors that determine the development of a given energy sector. At the same time, we cannot forget about the conditions resulting from the need to protect the environment, including natural and landscape values. Poland's energy industry is faced with the need to modernize and strengthen the National Electricity Grid. Worn-out coal-fired power stations need to be replaced with new production capacity. Some of them will still be based on coal,

which will continue to be the main source of energy in the next few decades, according to “Poland’s Energy Policy until 2030” (Ministerstwo Gospodarki, 2009).

### 3.1 Development of the labor market

The effects of renewable energy industry on the labor market can be observed on the scale of the whole country and the European Union in general. In the European Union, renewable energy sector in 2015 provided employment for 1 139 050 people, including 43 300 people in Poland, where many more people are employed in RES sector per unit of energy produced as opposed to the average in the UE (Table 1). The reason for that might be lower technological sophistication relatively to the leading European countries, for example, in case of Germany – regarding new photovoltaic or wind energy technologies (Graczyk, 2014), or Norway – its electricity generation is 97% renewable and the Norwegian government is planning on increasing sustainable energy use even more (Invest in Norway, 2017)

Table 1 Energy production and employment in renewable energy sources (RES) sector in Poland and EU in 2016

Technology	European Union			Poland		
	Energy production (ktoe)	Employment (jobs)	Number of employees per unit of production	Energy production (ktoe)	Employment (jobs)	Number of employees per unit of production
Hydropower	30053.0	46150	1.54	202.4	1450	7.16
Wind energy	24491.8	332350	13.57	833.0	11500	13.81
Solar PV, CSP and water heaters	9279.8	148050	15.95	4.9	3850	785.71
Solid biomass	7800.9	314700	40.34	776.2	18800	24.22
Biofuels in transport	13239.3	95900	7.24	780.3	6000	7.69
Heat pumps	8607.1	110900	12.88	25.7	750	29.18
All other renewables	8100.4	91000	112.34	77.9	950	12.2
<b>Overall</b>	<b>101572.3</b>	<b>1139050</b>	<b>203.86</b>	<b>2700.4</b>	<b>43300</b>	<b>879.97</b>

Source: Author’s own calculations based on EurObserv’ER, 2017b, EurObserv’ER, 2017c.

It can therefore be assumed, that dissemination of renewable energy technologies will result not only in increased employment in absolute terms but also in decreasing employment per unit of production, which means increased productivity, and consequently a decrease in unit costs.

The scale of the phenomenon above depends on the current advancement in the application of the technology. The data presented in table 2 indicates, that for example in the case of solid biomass technology and wind energy, in which Poland has a considerable scale of production and experience, employment per unit of production is already lower than the European average. This means that the Polish experience makes it possible to produce more electricity and heat with lower labor input, which makes Poland's RES competitive and attractive for foreign and domestic investments. Furthermore, calculations from table 2 and predicted data on the electricity production in Poland until 2030, presented in "Poland's energy policy until 2030" in attachment #2 (Ministry of Finance, 2009) obviously prove, that in 2015 Poland had already outperformed the forecasts.

**Table 2 Employment in the sectors of solid biomass (SB), wind energy (WE) and solar energy (SE) in terms of primary energy production in selected EU countries (2015)**

Country	Employment (jobs)			Energy production		
	SB (2015) – direct & indirect	WE (2015) – direct & indirect	SE (2015) – direct & indirect	SB (2015 Mtoe)	WE (2015 TWh)	SE (2015 MWth)
Germany	45400	142900	10600	12.062	79.206	13038
France	50000	22000	5900	9.661	21.249	2059
Sweden	27400	6500	100	9.129	16.268	327
Italy	22000	26000	3000	7.340	14.844	2809
Finland	23700	3300	50	7.901	2.327	37
Poland	18800	11500	2750	6.268	10.858	1413
UK	22300	41100	750	3.824	40.310	492
Spain	15800	22500	4000	5.260	49.325	2586
Austria	15450	5500	2800	4.474	4.840	3655
Portugal	7800	2500	450	2.603	11.608	826
Romania	11100	1100	200	3.521	7.045	136
UE	314700	332350	37300	91.444	301.893	34332

Country	Number of employees per unit of production		
	SB	WE	SE
<b>Germany</b>	3763.88	1804.15	0.81
<b>France</b>	5175.44	1035.34	2.86
<b>Sweden</b>	3001.42	399.55	0.30
<b>Italy</b>	2997.27	1751.54	1.07
<b>Finland</b>	2999.62	1418.13	1.35
<b>Poland</b>	2999.36	1059.12	1.94
<b>UK</b>	5831.58	1019.59	1.52
<b>Spain</b>	3003.80	456.15	1.55
<b>Austria</b>	3453.28	1136.36	0.77
<b>Portugal</b>	2996.54	215.36	0.54
<b>Romania</b>	3152.51	156.13	1.48
<b>UE</b>	3441.45	1100.88	1.09

*Source:* Author's own work based on: EurObserv'ER, 2017, EurObserv'ER, 2017a.

The worldwide renewable energy sector in 2016 employed 9.8 million people, directly and indirectly (with a 1.1% increase in 2016 over 2015). The most consistent increase has come from jobs in the solar PV and wind categories; it has more than doubled since 2012. In contrast, employment in solar heating and cooling and large hydropowers has declined. These employment trends can be attributed to several underlying factors. Falling costs and supportive policies in several countries, for instance, have spurred deployment of renewables at a record pace, and have resulted in job creation. However, these positive changes were moderated by lower investments, rising automation and policy changes, resulting in job losses in some major markets, including Brazil, Japan, Germany and France (International Renewable Agency, 2017)

The shape of the EU climate and energy policy clearly indicates the need to further increase the share of RES in the national energy mix. However, the dynamics of change, the specific value of the national RES target for 2030 and the contribution of wind energy to its fulfillment still depend on future political decisions. Therefore, the potential impact of wind energy on the Polish labor market until 2030, based for example on the study "Impact of wind energy on the Polish labor market" (Bukowski, Śniegocki, 2015) was determined on the basis of a scenario analysis, where three development scenarios of the sector in Poland: central, low and high were analyzed. It was assumed that, during 2018-2030,

investments in onshore wind farms will be as follows: 400 MW/year in central scenario, 200 MW/year in low scenario, and 600 MW/year in large scenario. It should be stressed that the re-acceleration of the development of wind energy sector is a prerequisite for the realization by Poland a binding target for the development of RES till 2020. Therefore, the realization of a low scenario means not only Poland's losing the development impetus for wind energy, but also a high risk of incurring the costs of failing to comply with the provisions of the EU climate change package.

Polish RES sector reforms, introduced by the Renewable Energy Sources Act 2015 (the 'RES Act'), which came into force on 1 July 2016 marked a significant step forward, however, subsequent amendments to the RES Act have illustrated that the Polish government is in a difficult position of striking a balance between developing RES for energy diversification and rescuing its coal industry. It is estimated (Pacula, 2017) that around 80% of Polish coal mines (mainly concentrated in the south-west region of Silesia) are unprofitable, the sector employs around 104000 people, with another 208000 people on miners' pensions. Poland has Europe's largest hard coal reserves, thermal coal and lignite accounted for 84% of the country's electricity generation in 2015 (Easton, 2016). Despite governmental subsidies, Poland's coal mining industry debts are still huge (Wood & Broom, 2017).

It is to be expected that despite the increased productivity of the industry, wind energy in Poland will generate more jobs per unit of energy than coal energy sector in subsequent decades, especially after employment restructuring in hard coal mining. According to author's survey, wind energy installations are usually locally oriented, in which case there is no need to build a centralized technical infrastructure. However, taking into account that RES creates jobs geographically more dispersed than conventional power stations, because it depends on the resources' location (González & Vélez, 2009), and the fact that it has higher rates of employment per MW installed than conventional energy (Rodríguez-Huertaa, Rosas-Casals, Alevgul and Sormanc 2017, p.557). It can be concluded that wind energy can successfully become a stimulating factor for economic development at the regional level.

The use of wind energy at the local level brings both economic and social benefits. One of the most important economic benefits is creating a strong impulse for local development resulting from the increase of local entrepreneurship, and hence an increase in the number of jobs. Unfortunately, this fact is not always obvious in various communes.

On the Polish labor market, the number of job offers related to wind energy is constantly growing. Specialists are being sought in the field of wind turbines

construction, there is a need for designers, assemblers, operators, service and maintenance technicians, environmental managers as well as experts in business development related to wind energy and investment advisors. Although the generated jobs are related to various activities during investment cycle, the largest number of jobs are created during the construction and installation phases.

The construction of wind farms in the communities may also constitute an additional source of income. The results of the study indicate that the construction of wind farms is not only an opportunity for the local community for additional employment, but it is also an opportunity to enrich the commune in the form of various types of taxes. In addition, the use of renewable energy is a strong support for communes and districts during their efforts to obtain external sources of financing from various types of EU funds as well as private investors for the implementation of investments in infrastructure owned by them.

Due to the significant depreciation of existing infrastructure in public utilities, these investments will have to be carried out anyway. Therefore, the development of wind energy sector can bring significant savings in planned investments and additionally boost local budgets. Inflows to municipalities where wind turbines have been located, in areas with favorable wind conditions, can account for up to 17-22% of the municipal budget. Furthermore, according to the author's research (Wasiuta, 2014) – more than 96% of analyzed communities consider tax revenues to the municipal budget and job creation potential to be the biggest benefits of RES development for the municipalities. That is why many municipalities “off-bottom” are seeking to put wind farms on their premises, and local governments are waiting for potential investors with open arms. The construction of a wind farms is often not only the aforementioned budget revenues, but also often an improvement, at the expense of investors, of the road network – 57% of analyzed communes consider this factor to be important. Not only the main roads and intersections, but also the construction of a network of roads in the fields between windmills, which farmers use willingly later on (Wasiuta, 2014)

Comparing employment level for RES sector with other sectors shows the scale of the impact of renewable energy development on the labor market in Poland and on the country's economy overall. Currently, the total number of jobs (table 2) created because of the development of wind energy (11 500), solid biomass (18 800) and solar energy (2 750) exceeds employment in the coke industry (4 000), cement (6 000) and lignite mines (5 000). In 2030 wind energy might create more jobs than coal mining which, after the inevitable restructuring (according to Warsaw Institute of Economic Studies (Bukowski & Śniegocki, 2015)) will employ about 4 to 16 thousand people. In contrast to the mining industry, the long-term perspectives arise from factors, which are beyond national control (for

example the situation on the global coal market, the ban on unprofitable mines in the EU and other). Moreover, as EU27 statistics show, coal reduced its share in the total primary energy supply from 22% in 1995 to 16% in 2009 (Markandya, Arto, González-Eguino, Romá, 2016, p. 1344)

The development of wind energy sector will depend largely on the shape of the regulations concerning renewable energy auctions introduced in Poland. It is worth noticing, that jobs that are dependent on wind energy sector are not concentrated in large industrial plants, and therefore less visible than employment in traditional heavy industry and mining. It should also be taken into account that rising automation in extraction, overcapacity, industry consolidation, regional shifts, and the substitution of coal by natural gas in the power sector result in job losses in the fossil-fuel sector in some countries. Poland has two options in this sector – either to invest in the mining sector (for example in new technologies) to increase efficiency and reduce costs, in order to be competitive on local and international markets – which would lead to a reduction in the number of employees or to continuously subsidize the mining industry in order to artificially sustain the sector and its employment (Wasiuta, 2014, p.150). Moreover, climate policies and the rise of renewable energy usage may add pressure on the sector. In some power markets, the increased integration of variable renewable energy in the grid is already creating financial issues for incumbent fossil fuel based generators (IRENA, 2017).

For example, employment in the coal industry worldwide is decreasing due to several factors such as power plants closing, overcapacity and improved mining technologies. China, for example, produces nearly half the world's coal, but excess supply and a slowing economy have led the government to plan of closing 5600 mines (Stanway, 2017) as well as cancelling plans to build more than 100 new coal-fired power plants (Forsythe, 2017) which can lead to the loss of 1.3 million coal mining jobs, which equals 20% of the total workforce in the Chinese coal sector (Yan, 2017). The Chinese government intends to spend more than \$360 billion through 2020 on renewable power sources and to increase employment in this sector to 13 mln. people (Total Investment In Renewable Energy Will Reach 2.5 Trillion Yuan, 2017).

The solar energy sector in Poland is one of the few exceptions with a rising statistics. According to the data presented in table 2, Polish solar industry employs 2 750 people and generates a turnover of 230 million euros.

In the times of frequent protests organized by local community members against the construction of wind turbines it is worth looking at places where wind farms coexist with the residents. For example the Kisielice community (*Gmina Kisielice*) in Poland is an interesting illustration of such situation. The local

authorities have found a way for a modern, ecological direction of change while ensuring a continuous flow of financial resources, also being the first and only energy self-sufficient community in Poland. Wind energy has been implemented there consequently since the late 1990s. The local community is happy, farmers are happy when their land is chosen for an investment, because they get a fair salary. In addition, the protection of the environment is a positive aspect for everyone while using RES sources. Projects aimed at using biomass and cogeneration for heating in the community have been implemented since 2003, led to the closure of coal-fired boiler houses, coal and oil heating systems in detached houses are being abolished successively. According to the author's research (Wasiuta, 2013) – 80% of respondents consider it to be significant or moderately significant that the development of renewable energy will contribute to regional development in the forms of self-employment and increasing jobs in that region which contribute to the development of different economic sectors, the development of transport infrastructure.

## 4 Conclusion

Renewable energy sources sector creates diverse jobs in production, services and construction, requiring a variety of qualification and skills. Its development not only increases but also improves the quality of jobs in the industry. The slowdown in the development of second biggest Polish RES sector, which is wind energy sector resulted from regulatory uncertainty when working on a law on renewable energy sources has led to a reduction in the scale of the related employment by 3.5 thousand people (Bukowski & Śniegocki, 2015) in 2012-2014. Due to the unfavorable regulatory environment, this trend will probably continue over the next few years.

Increase in employment requires a new impetus of investments. In the next decade, the dynamics of jobs created for example by wind energy sector, will be determined primarily by the size of expenditures for the construction of offshore wind farms.

Dissemination of any renewable energy technology will result in an increase in employment in absolute terms, but the decrease in employment per unit of production. Employment in relation to installed capacity in Poland is higher than the average in the EU (table 1). There is considerable potential for growth in revenues from renewable energy production (for example from income tax) and increasing employment in this sector.

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