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ECO-MODERNIZATION OF THE POLISH SECTOR OF ENERGY PRODUCTION IN THE CONTEXT OF IMPLEMENTATION OF THE GOALS OF THE EU 2021-2030 CLIMATE AND ENERGY PACKAGE

2.1 INTRODUCTION

The aspiration of contemporary states for constant technological progress and economic growth has a significant influence on the improvement of life quality of present and future generations. Nevertheless, despite the improvement, better prospects and development of industry and economy, there is a problem connected with the put more emphasis on environment protection in the process of shaping the policies of particular sectors. Rapid economic development of states resulted in the increase in the number of threats to the natural environment, which to large extent influence human health, and causes diseases of the respiratory, vascular and nervous systems [22].

The basic consequences of the pollution of the environment include acid rains, global warming and ozone holes. In Poland the natural environment is affected by conventional sources of energy used in heat and power plants powered by hard or brown coal, natural gas, which in turn results in high emission of CO_2, causing adverse changes in the climate. That is why sustainable development defined as 'social and economic development, in which the process of integration of political, economic and social actions takes place, in consideration of preservation of balance in nature and stability of basic natural processes, in order to guarantee the possibility of satisfying the basic needs of particular societies or citizens of both contemporary and future generations' [20]. The aim of the hereby paper is to present the issues related to eco-modernization of the energy sector in Poland.

Poland, as a member of the European Union, is also obliged to observe the principles and standards connected with activity of the energy production sector; thus the document of the new '2030 Climate and Energy Package', which assumes the reduction of the emission of greenhouses gases and increase in the share of renewable resources in energy production [9], is very important for Poland. In the Republic of Poland, this means that heat and power plants powered by brown, and to a large extent hard coal must be replaced by plants powered by natural gas. This kind of policy and actions in the

energy production sector are influenced by ecological innovation, which aims at reduction of the use raw materials, recycling, construction of nearly zero energy buildings, wider use of solar panels and wind farms, sustainable transport and construction of green areas for residents [15].

2.2 THE STRUCTURE OF THE POLISH ENERGY PRODUCTION SECTOR

In Poland, energy production sector and 'system transformation' were initiated by the Energy Law Act of April 10th, 1997, which specified the frames of functioning of the Polish market, also in the context of EU market.

Article 1.1. The Act specified the principles of developing energy policy of the state, principles and conditions of supply and use of fuels and energy, including heat, operation of energy production plants, and specifies the bodies competent in the area of fuel and energy economy. 2. The goal of the Act is to create conditions for sustainable development of the country, assure energy security, economic and rational use of fuels and energy, development of competition, prevent negative effects of natural monopolies, take into account the requirements of environment protection and obligations resulting from international agreements as well as balance the interest of energy production enterprises and receivers of fuels and energy. 2a The Act specifies the conditions for performing and monitoring activity, which consists in the transmission of Carbon dioxide for the purpose of underground storage and carrying out a demonstration project of capture and storage of carbon dioxide in the understanding of Article 1, point 3 of the Act of June 09th, 2011 – "Geological and Mining Law (Journal of Laws No. 163, point 981 and 2013, points 21 and 1238)" [18]

The analysis of the structure of energy production in Poland shows that there is a need to differentiate sources, since all areas of social and economic life require supplies of various origins. Tab. 2.1 presents the typology energy carriers widely used by contemporary countries in their economic practice.

Tab. 2.1 Energy sources

Energy sources		
Fossil fuels	**Nuclear fuels**	**Renewable sources of energy**
Hard coal Brown coal Oil Natural gas	Uranium Thorium Plutonium	Solar energy Geothermal energy Water energy Wind energy Energy of bio-mass

Source: [24]

In Poland, primary sources of conventional energy include: coal, natural gas, shale and bituminous sand [10]. Tab. 2.2 shows installed power of heat and power plants as of December 31st, 2014.

The Polish energy production market identifies new goals in accordance with the Council of Europe project concerning reduction of emission of greenhouse gases, de-

mand for energy and its generation for 2030 is forecasted. The aim of the project is to decrease the emission of gases and develop new sources of energy, since resources of primary energy carriers have depleted, and their production lasts many years [14]. Tab. 2.3 presents the planned structure of electric energy production net, depending on types of fuels, in Poland in 2030.

Tab. 2.2 Installed power in heat and power plants MW

Sources	Installed electric power [MW]
Brown coal	9220,5
Hard coal	20291,1
Natural gas	927,2

Source: [4]

Tab. 2.3 Production of electric energy net, depending on fuels, in Poland in 2030

Item	Share	
Hard coal	35,8%	(71,2 TWh)
Brown coal	21,0%	(42,3 TWh)
Natural gas	6,6%	
Oil	1,5%	
Nuclear fuel	15,7%	(31,6 TWh)
Renewable sources	18,8%	

Source: [4]

The goal of the progress in production of electric energy on the basis of renewable resources is protect the environment and increase energy security. The actions aim at increasing the volume of energy produced from renewable resources, while taking into accounts technological innovation and higher security of energy distribution at the local scale. According to the obligations of the climate package, Poland must achieve 15% share of renewable resources in energy consumption. Year by year, interest in renewable resources intensifies, for instance in 2001 the share was 2.4%, in the following year – 2.5%, in 2003 – 2.65% and 2010 as much as 7.7%. Until 2020 the share should be approximately 15%, which shows that the share of particular sources of energy contributes to bigger interest in the society [12]. Wind energy should play the most important role. In the energy balance it should constitute 11.6-14.3% of produced energy. Undoubtedly use of renewable energy resources requires help from support systems, which may guarantee systematic growth. Renewable energy resources include: geothermal energy – 8%, biomass – 15.4%, wind energy – 66.3%, solar energy – 9.8% and water energy – 0.5% [23].

2.3 THE GOALS OF THE EU CLIMATE AND ENERGY PACKAGE FOR 2021-2030

In March 2013, the European Commission Published 'The Green Book' which specified the framework of 2030 Climate and Energy Policy. The event started discussion on the new EU strategy in respect of climate and energy. The discussion on the new strategy turned out to be extremely difficult, yet on January 22nd, 2014, a new package

of proposals prepared by the European Commission was ready [9]. Two principle goals were identified in the January package prepared by the European Commission:

- 40% reduction of the emission of greenhouse gases before 2030 – relative to 1990 [17];
- 27% share of energy from renewable resources in the final energy consumption in the European Union before 2030 [5].

The European Commission held three sessions devoted to the approval of the new Climate and Energy Package. At first, in March, when conclusions were reached concerning the framework until 2030. Subsequent session took place in June, when The European Commission revised the progress of work. During the session held on October 23rd-24th, full consensus was achieved in respect of 2030 Climate and Energy framework, conclusions were accepted and what is more important, four important goals were approved [21].

The first goal is to reduce the emission of greenhouses gases in 2030 by at least 40% relative to 1990. At this point, it has to stressed that the current climate and energy package, approved by the European Parliament in 2008 and valid until 2020, assumes reduction of the emission of greenhouse gases by 20% relative to 1990 [3]. The goal of the reduction greenhouses gases was additionally divided into two limits [11]:

- limit for the EU ETS (European Union Emissions Trading System) assumes reduction by 43% in before 2030, relative to 2005, whereas the current 2020 package assumes reduction of greenhouses gases by 21%, also relative to 2005;
- limit for the Non ETS sector (sectors not covered by ETS, among others: agriculture, waste management or housing industry) – reduction by 30% before 2030, relative to 2005, whereas at present 10% reduction is assumed, also relative to 2015.

Reduction of the emission of CO_2 is undoubtedly one of the biggest challenges and problem for Polish energy production industry, since practically 90% of the production is based on combustion of coal, and Poland has rich deposits of this raw material. Energy production based on combustion of coal will increase in Poland every year due the price of the material but also in view increasing costs of permissions for CO2 emission. Over the years, increasing costs of CO_2 emissions may result in limited profitability of the construction of new plants or sooner closure of the existing plants powered by coal. The proposal of the European Commission, which permits the reduction of the costs of the emission of the carbon dioxide, is worth special attention. At the phase of negotiations, it was also possible to retain the quota of free permissions for CO_2 emissions for the Polish energy sector, in return for the obligation to initiate action aimed at the reduction of the emission of carbon dioxide.

Another goal of the package assumes at least 27% share of renewable resources in total energy consumption. In comparison with the present package, a growth of the share of renewable resources in total energy consumption by at least 7% has to be notices [17]. In view of the limitations resulting from the reduction of the emission of carbon dioxide and the requirements of the European Commission, to a certain extent, Poland

will be forced to increase investment in renewable sources of energy. The European Commission made steps to start a special fund for ten poorest counties of the European Union (including Poland), whose aim is to co-finance modernization of the energy system, which in turn will facilitate minimization of energy consumption.

The third goal applied to the improvement of energetic efficiency and assumes 27% reduction of the demand and for energy with the option of increasing to 30%, after analysis conducted in 2020. Just like in the case of the share of renewable resources, also here increase by at least 7% can be observed here, and after a positive result of the analysis, even by 10%, relative to the current limit and energy package, often referred to as '3x20' [11, 13].

The last of the goals of the accepted package supports the construction of the internal energy market, that is why urgent actions are necessary, which in 2020, could guarantee minimum 10% flow capacity of all international energy connections in each of the member states. Where as, before 2030, the flow capacity of energy connections should reach 15% [17, 21]. The new climate and energy package 2030 introduces many changes, relative to the current 2020 package; the differences are presented in Fig. 2.1.

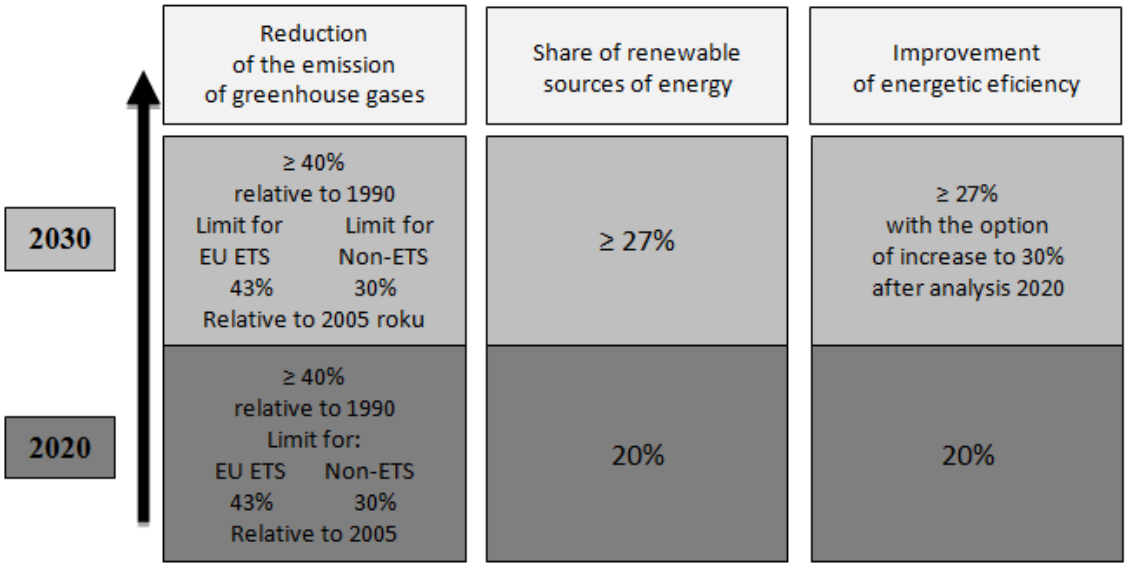

Fig. 2.1 Comparison of the current 2020 Climate and Energy Package and the new 2030 Climate and Energy Package

Source: [17]

2.4 ECO-INNOVATION AS THE CONDITION OF ECO-MODERNIZATION

Eco-innovation constitutes a significant element of the energy policy of all countries. It helps to prevent threats connected with excessive depletion of non-renewable resources, thanks to new technologies. It may lead to improvement of energy efficiency and simultaneous lowering of the costs of energy production and distribution. Background literature informs that „Eco-innovation is innovation which improves the efficiency of the use of natural resources in economy, decreases the negative impact of human activity on the environment or strengthens the resistance of economy to environmental pressure" [1]. Implementation of new, environment friendly technologies or pro-

ducts has numerous advantages not only for the environment, but also for entrepreneurs. It results in better customers' image of the company, higher competitiveness of enterprises, and what is more, such investments are co-financed by the European Union, which positively affects their risk assessment [6]. There are four types of innovation which can be implemented by enterprises [16]:

- process eco-innovation – completely new or significantly improved forms of production, delivery, whose introduction minimizes the effect on the natural environment;
- product eco-innovation – completely new or significantly improved environment friendly products or services, whose introduction has minimized effect on the natural environment;
- marketing eco-innovation - completely new or significantly improved methods of marketing , whose introduction minimizes the effect on the natural environment;
- organizational eco-innovation - completely new or improved organizational methods, whose introduction minimizes the effect on the natural environment.

The aim of the new 2030 Climate and Energy Package is to reduce the emission of greenhouse gases by 40% and increase the share of renewable energy resources by 27%. Modernization of the energy sector requires ecological innovation facilitation the implementation of these goals. The following forms of innovation have to be introduced in conventional energy production [2]:

- increase in the use of bio-mass in production of energy and heat;
- equipping energy installations with systems improving energy efficiency , reducing the emission of carbon dioxide into the atmosphere e.g. CCS (Carbon Capture and Storage Systems);
- introduction of co-generation in order to reduce fuel consumption;
- minimization of cogeneration circulation;
- improvement of the efficiency of systems using geothermal energy;
- installation of hybrid systems, fuel cells;
- modification of gas-steam systems.

Fortrum introduced eco-innovation in Fortrum Heat and Power Plant in Częstochowa. Fluidized bed combustion boiler, in which coal and bio-mass are combusted, is responsible energy and heat generation [7]. The emission of carbon dioxide was reduced by 635 thousand tons. The company plans to improve the technology. The following forms of ecological innovation can be distinguished in energy production industry based on RES [2]:

- development of systems of acquisition of biological products;
- development of the systems of acquisition of renewable energy sources;
- development of systems transforming water energy into electric energy;
- introduction of hydrogen production – „the fuel of the future".

Siemens implemented modernization of four schools and one kindergarten in the Radzionków commune. Within one year the emission of carbon dioxide by these institu-

tions decreased significantly. The changes applied to installations, lighting and heat centres [8]. Implementation of renewable resources of energy is particularly important in Poland. Ecological innovation may lead to the independence of the state from foreign suppliers, and reduction of the emission of greenhouse gases may reduce the negative pressure on the environment [19].

CONCLUSIONS

The paper presents the challenges; the Polish energy production sector faces in view of the EU goals included in the new 2030 Climate and Energy Package. The most important challenges facing the Polish energy sector before 2030 include;

- 40% decrease in the emission of greenhouse gases;
- 27% increase in the share of RES;
- realization of the limits for the EU ETS sector, assuming reduction of the emission of greenhouse gases by 23% before 2030, relative to 2005;
- realization of the limits for the Non ETS sector, assuming the reduction by 30% before 2030, relative to 2005;
- supporting the construction of the internal energy market, guaranteeing 15% energy flow of international energy connections in all member states by 2030.

It seems that technological innovation in the sector constitutes one of the most important instruments of the realization of those ambitious goals in the forthcoming years. The realization of the EU policy in this area depends on the ability to implement them. Undoubtedly, this will facilitate the development of research and development centers focused on the development of new, significantly improved pro-ecological technologies in the energy production sector as well as the development of the Polish RES sector.

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ECO-MODERNIZATION OF THE POLISH SECTOR OF ENERGY PRODUCTION IN THE CONTEXT OF IMPLEMENTATION OF THE GOALS OF THE EU 2021-2030 CLIMATE AND ENERGY PACKAGE

Abstract: *The paper discusses the issue of eco-modernization of the Polish sector of energy production in the light of new goals of the European Policy included in the '2021-2030 Climate and Energy Package'. It focuses on the presentation of challenges in transformation of the Polish sector of energy production resulting from strategic goals of the EU in this area.*

Key words: *energy market, transformation in energy production industry, energy policy*

EKO-MODERNIZACJA POLSKIEGO SEKTORA WYTWARZANIA ENERGII W KONTEKŚCIE REALIZACJI CELÓW UNIJNEGO PAKIETU KLIMATYCZNO-ENERGETYCZNEGO NA LATA 2021-2030

Streszczenie: *Artykuł podejmuje zagadnienie eko-modernizacji polskiego sektora wytwarzania energii w świetle nowych celów polityki europejskiej zawartych w pakiecie energetyczno-klimatycznym na lata 2021-2030. Koncentruje się na ukazaniu wyzwań o charakterze transformacyjnym dla polskiego sektora wytwarzania wynikających ze strategicznych celów wspólnoty w tym obszarze.*

Słowa kluczowe: *rynek energii, transformacja energetyczna, polityka energetyczna*

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