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ASSUMPTIONS OF THE CLIMATE POLICY AND COAL MINING IN THE EUROPEAN UNION

Abstract. The article applies to the EU strategy for the climate protection in terms of reducing greenhouse gas emissions. The key assumptions of the climate package were discussed, along with the tools on the emission reduction, such as: European Union Greenhouse Gas Emission Trading System (EU ETS), Joint Implementation (JI) and Clean Development Mechanism (CDM). As a research method, case studies and literature studies were used. The impact of the climate package on the coal industry in the EU countries has been presented, with special regard to the situation of Poland.

Keywords: sustainable development, climate change, energy sector

ZAŁOŻENIA PAKIETU KLIMATYCZNEGO A GÓRNICTWO WĘGLA W UNII EUROPEJSKIEJ

Streszczenie. Artykuł dotyczy strategii UE na rzecz ochrony klimatu w ramach ograniczania emisji gazów cieplarnianych. Omówiono podstawowe założenia pakietu klimatycznego wraz z narzędziami dotyczącymi redukcji emisji, takimi jak: system handlu uprawnieniami do emisji (EU ETS), wspólne wdrożenie (JI) i mechanizm czystego rozwoju (CDM). Jako metody badawcze wykorzystano studia przypadku i badania literaturowe. Zaprezentowano wpływ pakietu klimatycznego na przemysł węglowy w krajach UE, ze szczególnym uwzględnieniem sytuacji Polski.

Słowa kluczowe: zrównoważony rozwój, zmiany klimatu, sektor energetyczny

1. Introduction

The industrial revolution, dynamic economic growth and population growth in the world mainly affect to an increase in demand for electricity.

The global population is increasing by 83 million people per year, i.e. within roughly five decades, the number of people has doubled between 1960 and today. At present, approximately one quarter of the global population of nearly 7.2 billion people do not yet have access to electricity. Electricity consumption will grow faster than any other form of energy consumption. It is expected that during the period 2012 to 2040 in all fields and regions the annual demand will increase by 2.1%[1].

Meeting the growing energy needs requires burning of fossil fuels, which generate greenhouse gas emissions GHG (Greenhouse Gas). These gases let the solar radiation to the Earth's atmosphere, but they do not let the thermal radiation out of it.

The energy sector is responsible for 2/3 of the world's GHG emission and 80% of carbon dioxide emissions. Demand for electricity in 2014 increased by 150% compared to 1971, where still 82% of the energy comes from burning fossil fuels, and the renewable energy sources constitute only 18%. Therefore, the exponential trend of greenhouse gas emissions, which in 1980 amounted almost zero to over 32 $GtCO_2$ in 2014[2].

The global treaty, known as the Kyoto Protocol, requires the developed countries to have an obligation to reduce emissions of seven greenhouse gases. These are: carbon dioxide (CO_2): derived from the combustion of fossil fuels, wood or any products made of coal, absorbed by plants and trees, — methane (CH_4): formed naturally or as a result of human activity, among others during production of fossil fuels, in animal husbandry, as a result of rice cultivation and waste management, — nitrous oxide (N_2O): fertilisers are the source of its emission, as well as combustion of fossil fuels and industrial production of chemicals using nitrogen, — four types of fluorinated gases, developed for industrial purposes: hydrofluorocarbons (HFC), perfluorocarbons (PFC), sulphur hexafluoride (SF6) and nitrogen trifluoride (NF3)[3].

68% of global emissions are caused by 10 countries belonging to the group of the largest issuers, i.e., China (28%), the USA (16%), India, Russia, Japan, Germany, Korea, Iran, Saudi Arabia. In 2012, the EU was responsible only for 8% of global greenhouse gas emissions. Currently, this percentage is decreasing, as the EU reduces its own emissions, while in other

[1] WGB PowerTech Journal. Facts and figures Electricity generation 2015/2016. https:// vgb.org/en/data_powergeneration.html
[2] CO_2 emissions from fuel combustion, Highlights 2016. International Energy Agency. https://iea.org/publications/freepublications/publication/CO2EmissionsfromFuelCombustion_Highlights_2016.pdf
[3] European Commission. Climate action. Luxembourg 2014.

parts of the world the emission is constantly increasing, particularly in the major emerging economies[4].

Recognising the problem of increased emissions of greenhouse gases due to human activities, the United Nations affiliated countries in 1992 adopted the Framework Convention of the United Nations on the Climate Change (UNFCCC). It was aimed at "stabilizing greenhouse gas concentrations in the atmosphere at the level, which would prevent the dangerous anthropogenic interference in the climate system" and the initiation and systematization of efforts to reduce greenhouse gas emissions by the agreement signatories.

The Kyoto Protocol adopted in 1997 is a document supplementing the Convention. The agreement came into force in 2005 and was aimed at reducing greenhouse gas emissions in the period of 2008-2012 by an average of at least 5 percent below the level of emission from 1990. The expected level of reduction in individual countries was diversified. Poland found itself in a group of counties, which have committed to reduce greenhouse gas emissions, expressed in carbon dioxide equivalent by 6% in relation to the base year, i.e., 1990. Three countries: Iceland, Australia and Norway have been authorised to increase their emissions in relation to 1990, respectively, by 10%, 8% and 1%. Another three: Russia, Ukraine and New Zealand can maintain the emission at the level from 1990, and the other parties have undertaken to reduce emission by 5% - 8%.

The European Union is leading the global action against climate change, both by setting out international actions aimed at reducing global warming to the level of 2°C, as well as through their own commitment to very significant greenhouse gas emissions reduction.

Fighting climate change is one of five most important topics of the "Europe 2020" strategy for the smart, sustainable economic growth in favour of the social inclusion. Its main goals are to reduce the level of greenhouse gas emission by 20 percent in the EU, to achieve 20 percent of energy from renewable sources and to increase the energy effectiveness until 2020 by 20 percent. The first two of the above-mentioned objectives were implemented within the "climate and energy package", which was adopted in June 2009.

The aim of this article is to analyze the European Union's strategic actions for climate protection in reducing greenhouse gas emissions. As a research method, case studies and literature studies were used. The basic assumptions of the climate package are discussed together with the tools for reducing emissions such as: European Union Greenhouse Gas Emission Trading System (EU ETS), Joint Implementation (JI) and Clean Development Mechanism (CDM). The impact of the climate package on the coal industry in EU countries, with particular emphasis on the Polish situation, is also presented.

[4] https://ec.europa.eu/clima/policies/strategies/progress_pl

2. The main objectives of climate policy

The framework of the climate and energy policy until 2030 was adopted by the EU leaders in October 2014. It will be the engine of steady progress towards a low carbon economy and it will serve as proof of the EU's ambitions in the context of international negotiations on combating climate change. The aim of this policy framework is to build an energy system, which will provide consumers with affordable energy prices, increase security of energy supply to the EU, reduce the EU's dependence on the energy import, reduce greenhouse gas emission and will create new opportunities for green growth and creation of environmentally friendly workplaces[5].

EU announced new targets for the climate and energy policy which are to be met by 2030. Compared to the 1990 reference values, GHGE are to be reduced by 40% in order to support the global target of limiting global warming to less than 2°C. By 2050, GHGE are to be reduced by 80 to 95%. It is also planned to raise the annual upper limit (cap) of GHGE from currently 1.74 to 2.2% for the post-2020 period.

The Kyoto Protocol provides for three instruments to achieve the objectives[6]:

- European Union Greenhouse Gas Emission Trading System (EU ETS),
- Joint Implementation (JI),
- Clean Development Mechanism (CDM).

European Union Greenhouse Gas Emission Trading System (EU ETS) has three phases of implementation. The first phase fell for the period of 2005-2007, when the system covered the installations of the energy and thermal industry with a high level of carbon dioxide emissions. In the second phase, in 2008-2012, the system additionally covered the installations emitting nitrous oxide due nitric acid production. Currently the third phase of ETS is taking place, which covers the emission of carbon dioxide (CO_2) by power plants, energy-intensive sectors and commercial airlines, as well as emissions of nitrous oxide in the production of certain acids and perfluorocarbons associated with the production of aluminium. The competent national authority shall issue a permit to emit greenhouse gases, if it is convinced that the operator is capable of monitoring and reporting on their emission. As part of a single EU-wide number of allowances (reduced annually by 1.74%) the operators receive or purchase allocation for emissions, which they can trade with each other, if necessary. They can also exchange the limited number of international emission units for allowances, obtained as a result of implementing the programs for limiting greenhouse gas emission worldwide. The operators are require to monitor and report on the issue of emissions to competent authorities. The reports are checked by independent controllers. After the end of each year, the operators must have a sufficient number of allowances to cover the total

[5] European Commission. Climate action. Luxembourg 2014.
[6] Ranosz R.: Organizacja i handel uprawnieniami do emisji CO_2. Polityka Energetyczna, t. 11, z. 2, 2008, s. 85.

emissions; otherwise, fines are imposed. From 2013, the sale of allowances in the auction system is used by default. The share of free allowances received by the industrial plants will drop to 30% in 2020. As a rule, no free allowances for the production of electrical energy are distributed. The EU countries must use at least 50% of the revenues obtained from the distribution of allowances through the auction sales for purposes related to climate protection (e.g. reducing the carbon dioxide emission intensity). Each year, the EU countries submit a report to the Commission informing on the use of the directive. In July 2015 a proposal was adopted to revise the EU ETS for phase 4 (2021–2030) under the framework of the climate and energy policy until 2030. The proposal aims to reduce emissions covered by EU ETS by 43% compared to 2005[7].

The second mechanism for reducing greenhouse gas emissions is Joint Implementation (JI), which consists of fulfilling reduction commitments by the states by creating the possibility to include the reduction achieved through investments in another country. The investing country reduces its costs of emission reduction (compared to the coasts, which it would have to bear while implementing national investments) and increases its emission limit. While the host country (host of the project) gains the environmentally friendly, modern technologies. As a result of the JI project implementation, the emission reduction units (ERUs) are obtained, which are transferred from the host country to the investing country.

The third instrument is a Clean Development Mechanism (CDM), which means the investment operation implemented by the state listed in Annex I to the Climate convention in the territory of another country not listed in this annex, which aims to reduce, avoid or absorb greenhouse gases. As a result of the implementation of a specific project the so-called Certified Emission Reduction (CER) is obtained, which mean the unit of a reduced or avoided greenhouse gas emission. Units obtained this way can be used by the parties listed in Annex I to the Climate convention in order to fulfil their obligations.

3. The impact of the climate policy on coal mining in the EU

The European Union member states are a leader in the development of renewable energy sources. In the overall energy balance of the EU, only 45.8% of energy comes from fossil fuels, i.e., coal, oil and gas; 12.5% is nuclear energy, 20% is hydropower and 21.7% are renewable energy sources. 78.5% of the energy produced in the entire EU is created in eight countries, which include: Germany, France, Great Britain, Italy, Spain, Poland, Sweden and

[7] http://eur-lex.europa.eu/legal-content/PL/TXT/?uri=URISERV%3Al28012

the Netherlands. These countries vary greatly in terms of the structure of electric energy sources, which is presented in table 1, and the levels of energy intensity of the economies.

Table 1

The structure of the energy mixes of the selected EU countries

Energy production [Gwhe]	Nuclear energy	Coal	Oil	Gas	Biomass	Water power	Wind power	Solar power	Geothermal power
Germany	15.5%	37.8%	0.2%	17.4%	9.0%	3.7%	10.4%	5.9%	0.1%
France	73.0%	2.6%	0.2%	6.6%	1.8%	10.9%	3.8%	1.0%	0.1%
Great Britain	16.3%	27.9%	0.4%	40.7%	3.9%	1.4%	8.7%	0.4%	0.2%
Italy	0.0%	16.9%	1.5%	48.3%	4.6%	15.4%	3.9%	7.3%	2.0%
Spain	19.1%	11.1%	5.1%	27.5%	3.3%	10.0%	18.5%	5.3%	0.0%
Poland	0.0%	86.1%	0.5%	3.9%	5.2%	1.9%	2.4%	0.0%	0.0%
Sweden	39.3%	0.5%	0.4%	1.5%	10.6%	42.1%	5.7%	0.0%	0.0%
Netherlands	3.0%	28.7%	0.8%	50.2%	8.5%	0.1%	8.6%	0.1%	0.0%

Source: Own study based on: EC – European Commission: EU Energy. Transport and GHG Emissions. Trends to 2050 Reference scenario 2013 Publication Office of the European Commission 2013.

Restrictions on emission reductions contained in Energy Roadmap 2050 adopted by the member states assume the decarbonisation of the electricity sector and reduction of emissions by 80-95% in 2050 compared to 1990[8].

The development of renewable energy sources, which include biomass and waste, hydropower, wind and geothermal energy, are the means to achieve these objectives. The share of biomass in Sweden 10.6%, in Germany 9%, in the Netherlands 8.5%, in Poland 5.2%, in Italy 4.6%, in Great Britain 3.9%, in Spain 3.3% and in France only 1.8%. Hydropower is the most widespread in Sweden and it makes up 42.1% of the share in the energy mix of this country, then there is Italy with the share of 15.4%, Spain and France with the share of 10%, Germany 3.7%, Poland 1.9% and Great Britain 1.4%. Wind energy has the largest share in the energy mix in Spain and it constitutes 18.5% of the produced energy, then Germany 10.4%, Great Britain and the Netherland over 8%, Sweden 5.7%, Italy and France over 3%, Poland 2.4%. Solar energy represents 7.3% of the energy produced in Italy, 5.9% of the energy produced in Germany, 5.3% of the energy produced in Spain. Geothermal energy constitutes the highest share in Italy at the level of 2%, in Great Britain 0.2%, Germany and France at the level of 0.1%.

When it comes to renewable energy sources, the highest total share in the energy mix of the eight studies largest energy producers in the EU is observed in Sweden with up to 58.4%, Spain (37.10%), Italy (33.20%), Germany (29.10%), France (17.6%), the Netherlands (17.30%), Great Britain (14.6%) and Poland (9.5%). The remaining part of the energy materials used in the energy production are the fossil fuels: coal, oil and gas. Poland has the

[8] https://ec.europa.eu/energy/sites/ener/files/documents/2012_energy_roadmap_2050_en_0.pdf

highest share of coal in the electric energy production and it amounts up to 86.1%, in Germany 37.8%, in the Netherlands 28.7%, in Great Britain 27.9%, in Italy 16.9%, in Spain 11.1%.

The European Union is the world's fourth largest coal consuming region, after China, India and North America. UE mine around one hundred million tonnes of hard coal each year and import a further two hundred million tonnes, making UE the world's largest importer by value. At around four hundred million tonnes, our lignite production far exceeds that from any other region, Germany being the world's largest producer. Although the European Union is currently implementing the strictest climate policies in the world, coal still accounts for around one quarter of the electricity consumed in the Union, it being the most reliable source of power with 178 GW of coal-fired capacity available at all times and whatever the weather.

Many pollution control technologies have been deployed at coal-fired power plants, *e.g.* wet and dry flue gas desulphurisation, primary and secondary NOx reduction systems and many dust control techniques. The tangible result is that between 1990 and 2012 the EU coal-fired power sector reduced its sulphur dioxide (SO_2) emissions by 85%, NOx emissions by 55% and dust emissions by 70%. In the case of SO_2, atmospheric concentrations are now well below the limits for health protection. Unfortunately, NOx emissions remain too high because of emissions from transport. The gradual introduction of electric vehicles will see NOx emissions fall[9].

The decline trend in coal production in the EU states does not, however, mean the abandon of coal use, which is confirmed by the data in the import of this raw material, which show that in 2015 Germany 55, United Kingdom 25.5, Italy 19.6, Spain 19, France 14.3, Netherlands 12.4 and Poland 10were the largest importers of coal in million tonnes[10].

Natural gas has the highest share in the energy mix in the Netherlands and it constitutes 50.2%, in Italy 48,3%, in Great Britain 40.7%, in Germany 17.4%, in France 6.6%, in Poland 3.9% and in Sweden 1.5%. The share of crude oil is the highest in Spain and it constitutes 5.1% and in Italy with 1.5%, in the remaining studied countries the oil share is under 1%. It is worth mentioning here that the gas considered as an alternative to coal is not a zero-emission fuel, its emissions are only half smaller than coal, moreover, it is an imported fuel. Nuclear power is the most widespread in France, where it represents 73% of the share in the energy mix, Sweden is the second, with the share of 39,3%, along with Spain 19.1%, Great Britain 16.3%, Germany 15.5%. There are no nuclear power plants in Poland and in Italy.

The EU energy policy assumes the development of renewable energy sources, as a tool aimed at increasing the energy independence. Unfortunately, currently, despite many activities in this area and the increase in energy demand, the EU states are still characterised

[9] EACL – European Association for Coal and Lignite. 6th report 2015 Coal industry across Europe.
[10] http://euracoal.eu

by a high level of energy dependence[11]. On average, the EU level of energy dependence is 53.2%. The highest level of energy dependence can be observed in Germany 62.7%, then in France 47.9%, Great Britain 46.4%. The lowest levels of dependence is found in the Czech Republic (27.9%) and Poland (25.8%) because they are largely based on their own fossil fuels, and Denmark 12.3% using renewable sources[12].

Requirements for climate protection in the EU states led to the decrease in overall emission in 2014 with respect to 1990 by almost 23% due to the increased use of renewable energy sources, reduction of fossil fuels use and improvement of energy effectiveness[13]. The emissivity levels of the EU economies are still very diverse primarily due to the structure of energy mixes and the level of development of member states. It turns out that the countries with the highest level of development show two or three times higher emissions per capita in relation to countries with a lower level of development, which should be a significant argument in the discussion in terms of emission limits. More in [14].

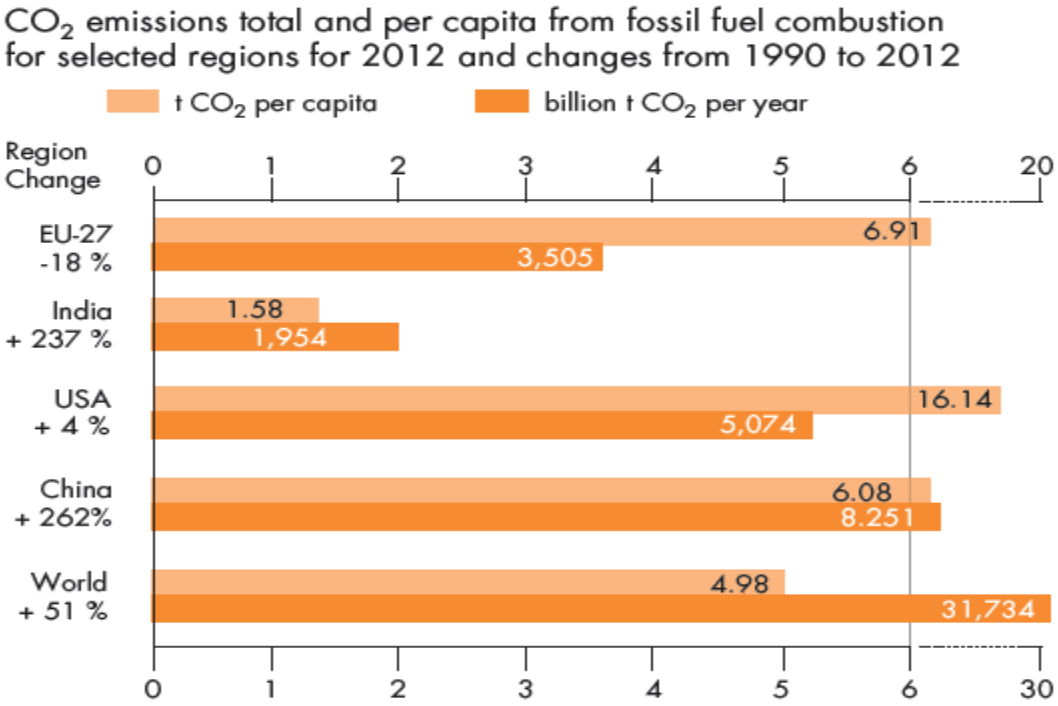

Fig. 1. Emissions from fossil fuel combustion
Source: WGB PowerTech Journal. Facts and figures Electricity generation 2015/2016. https:// vgb.org/en/data_powergeneration.html

[11] Bluszcz A.: European Economies in terms of energy dependence. "Quality & Quantity", Vol. 51, No. 4, 2016, p. 1531.
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[13] Kijewska A., Bluszcz A.: Ślad węglowy, jako miernik poziomu emisji gazów cieplarnianych w krajach Unii Europejskiej. „Przegląd Górniczy", t. 72, nr 8, 2016, s. 42.
[14] Kijewska A., Bluszcz A.: Research of varying levels of greenhouse gas emissions in European countries using the k-means method. "Atmospheric Pollution Research", Vol. 7, No. 5, 2016, p. 935.

The level of CO_2 emission per capita is an important indicator. In 2014, 4.9 t of CO_2 accounted for one citizen. When it comes to the largest CO_2 issuers, the CO_2 emissions per capita in these countries amount to: in the USA – 17.4 tonnes, in China – 7.1 tonnes, in the EU28 – 6.8 tonnes, and in India – 2.0 tonnes. In the United States, although the emission per capita is the highest in the world, it should be emphasised that it has decreased by 16% since 1990. Among the countries, in which the CO_2 emission per capita decreased in 2014 compared to 1990 we can observe, e.g., Germany – a decrease of 26% (the emission level of 9.3 tCO_2), Great Britain – a decrease by 35% (the emission level of 6.5 tCO_2); Poland – a decrease of 17% (the emission level of 7.8 tCO_2), Russia – a decrease of 23% (the emission level of 12.4 tCO_2), Canada – a decrease of 2% (the emission level of 15.9 tCO_2). However, in many countries the CO_2 emission per capita increased. In China, since 1990, the emission per capita increased by 262%, in India by 146%, in Japan there was a 5% increase (the emission level of 10.1 tCO_2 per capita), in Australia the emission increased by 7% (the emission level per capita is one of the biggest in the world and amounts to 17.3 tCO_2 per capita). In Saudi Arabia a 62% increase was noted reaching one of the highest levels in the world, 16.8 tCO_2 per capita[15].

4. The effects of the climate policy on coal mining in Poland

Electricity production in Poland in 2012 amounted to 161,95 TWh in a significant part based on solid fuels 84%, was slightly higher than the national demand for electricity, so that our country belongs to the group of exporters of net electric energy (the largest in the EU: France, Germany, the Czech Republic). Poland occupies the tenth position in the world in terms of production of electricity from coal, the second place among the EU countries (Germany being the first). Poland has vast resources of coal and lignite. In terms of coal mining, Poland is the largest producer in Europe, and in the case of lignite, it comes second, after Germany, which is the biggest producer of this material in the world[16]. These rich resources of coal and lignite are the basis of raw materials of the national energy system[17, 18].

[15] Trends in global CO2 emissions. 2015 Report. PBL Netherlands Environmental Assessment Agency http://edgar.jrc.ec.europa.eu/news_docs/jrc-2015-trends-in-global-co2-emissions-2015-report-98184.pdf (access May 2016).
[16] Gawlik L. (red.): Węgiel dla polskiej energetyki w perspektywie 2050 roku – analizy scenariuszowe. Górnicza Izba Przemysłowo-Handlowa, Katowice 2013.
[17]Gawlik L., Mokrzycki E.: Scenariusze wykorzystania węgla w polskiej energetyce w świetle polityki klimatycznej Unii Europejskiej. „Przegląd Górniczy", t. 70, nr 5, 2014, s. 1.
[18]Grudziński Z., Stala-Szlugaj K.: Pozycja węgla kamiennego w bilansie paliw i energii w kraju. „Polityka Energetyczna", t. 17, z. 3, 2014, s. 49.

The EU policy in terms of reducing the CO_2 emission is a huge challenge for Poland, which impacts the level of competitiveness of coal fuel as the currently cheapest fuel in the production of electric energy, as presented in figure 2.

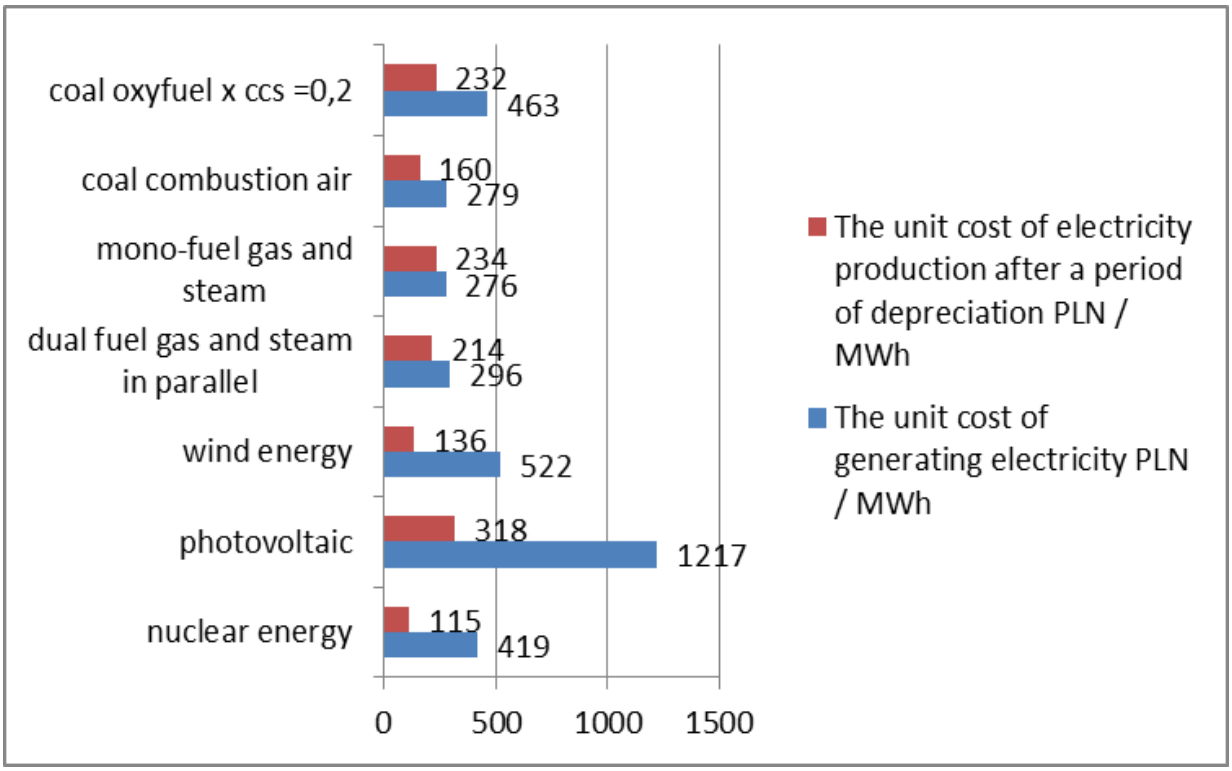

Fig. 2. A summary of average unit costs of electricity production in individual technologies of its manufacturing

Source: Bartnik R., Hnydiuk-Stefan A.: Analiza ekonomiczna jednostkowych kosztów produkcji elektryczności w różnych technologiach jej wytwarzania. „Energetyka", nr 5, 2016, s. 257.

The climate package is a major challenge for Poland in terms of the development of coal and lignite mining, among others, through the threat of administrative enforcement of the emission reduction in the turnover, or the increased reductive targets in the perspective of 2020 and beyond, the uncertainty of energy producers, as for the level of authority prices, and consequently their impact on the costs of energy production and the forced share of energy produced from renewable energy sources and the degree of subsidizing these sources (disturbing the competition of producing energy from other media)[19].

A major asset for the development of mining in Poland comes from the fact that coal is the cheapest source of energy[20], and its resources amounting to 48 billion tons are the foundation and stabilizer of the Polish energy security[21]. Maintaining the role of hard coal, as a strategic sector of the economy, will require the further intensive restructuring process of this

[19] Gawlik L. (red.): Węgiel dla polskiej energetyki w perspektywie 2050 roku – analizy scenariuszowe. Górnicza Izba Przemysłowo-Handlowa, Katowice 2013.

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industry[22, 23, 24] and the implementation of innovations, which will contribute to maintaining the market competitiveness[25] and meeting the environmental requirements.

5. Summary

The ambitious goals of the climate and energy package in the EU are justified from the point of view of environmental protection against the ever-growing greenhouse gas emission. The EU states as the countries with a high level of economic development have undertaken the implementation of the decarbonisation policy as the advanced countries in this scope in the global scale. The results of these actions can in the long term have an impact on the level of competitiveness of European economies, because the energy intensive industry is moved to other parts of the world, mainly to Asia, where the limits in terms of emission do not apply. Achievements in reducing emissions in one region of the world, i.e., in the EU, which accounts only for 8% of the global emission, calls into question the issue measurable in terms of the global effects of these costly activities, and it should be added that only the efforts in the global scale can produce a significant effect. Due to the significant diversification of the energy production structure of the member states, the countries with the highest share of carbon in the energy mix will bear the highest costs of economic transformation towards increasing the share of renewable energy sources.

In the face of the theory that in the pool of 100% of greenhouse gases participating in the so-called greenhouse effect, the share of anthropogenic CO_2 is only 1.2%[26] and that it is the nature, and not human activity, that governs the climate [27] the direction of restrictive measures to reduce emissions should take place taking into consideration the specific circumstances of the member states (including Poland), the level of economic development of the countries, in order not to limit the economic growth and to minimise the consequences of the carbon-leakage effect.

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