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DOI: 10.15290/oes.2023.01.111.10

## **SUSTAINABLE ENERGY POLICY WITH AN ENVIRONMENTAL DIMENSION – TOWARDS DECARBONIZATION<sup>1</sup>**

### **Summary**

*Purpose* – The article poses a research question: Is decarbonization an alternative or a necessity? In view of the current problems with coal supplies on the one hand, and the need to take care of the environment on the other, the question posed takes on a deeper meaning. Particularly when sustainable management of natural resources and broad energy policies appear in the background. Therefore, the research hypothesis is: “decarbonization, as one of the recently imposed trends, is indicated from the point of view of sustainable management of natural resources as part of the energy policy and and as a desirable solution in order to to take care of the environment and current problems with coal supplies”.

*Research method* – The article uses several research methods: literature studies, secondary data analysis, analysis of figures in the economic aspect or elements of comparatism.

*Results* – The analysis shows that decarbonization is desirable (it is supported by economic and environmental considerations). Moreover, it is a necessity and follows from the adopted national energy strategy, which is influenced by the EU’s climate and energy policy, based on the pursuit of climate neutrality of the EU by 2050.

*Originality/value/implications/recommendations* – The presented point of view, supported by a preliminary analysis of available statistical data, can be considered as the author’s opinion leading to more in-depth analyses based on more and more recent data

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<sup>1</sup> The funding source: The article financed from the funds from the project: SUPB. RN.21.109, Id: 538, [ZPPZ/2022/00286, 24.03.2022]. The paper received support from the Ministry of Science and Higher Education as part of the donation to maintain the research potential of WPiNS of the Jan Kochanowski University in Kielce.

Article received on 11.10.2022, accepted on 22.02.2023.

in the future. In view of the above, the article is a voice in the discussion on the role and importance of energy policy, in the context of the concept of sustainable development, with a particular focus on one of the components of the European Green Deal. The included commentary on decarbonization, treated as one of the recently imposed trends, was intended to stimulate the reader's thoughts and their own assessment of the changes taking place and the challenges that go along with them. The text was developed as part of the research project: SUPB.RN.21.109, Id: 538.

**Keywords:** sustainable development, energy policy, decarbonization, environmental governance.

**JEL classification:** P18, P48, Q01, Q42, Q5

## 1. Introduction

Over the past hundred years, the doubling of the world's population has resulted in a significant increase in production (and not only the production of food). Quantitative data show that a hundred years ago the said production was 25 times lower than today. It is also estimated that the amount of carbon dioxide, released into the atmosphere, at the time when this important – from the point of view of globalization and social development – increase in GDP took place, doubled, when compared to the state from a century ago. What is more, the growing production required the consumption of a significant amount of energy. This was possible mainly due to the combustion of fossil fuels (still about 80% of the energy produced in the world comes from burning coal, oil and natural gas) [Orłowski, 2022, pp. 306–307].

It is not surprising to say that the electricity is essential for further development in the 21<sup>st</sup> century. However, it raises the question of whether we still need as much of it as we did before. What is more, hasn't some of the energy production to date been overly wasted in recent years, causing contamination of the environment and increasing the Earth's temperature (something scientists are more and more often talking about, in the context of forecasts for the next few decades)? Changes aimed at saving energy (if the situation calls for it) are not just, colloquially speaking, replacing overly energy-intensive household appliances, cars or light bulbs. They require rebuilding of the mindset of global society, and thus building a new energy system (if necessary: from scratch). Tracking down a few contamination-generating facilities and forcing them to install filters [Rogall, 2010, pp. 38–39] is definitely not enough, especially in the context of sustain-

ability management criteria and rules. Therefore it may be worth answering the question: Are we witnessing conflicts and wars over climate and resources, as Welzer wrote in 2008? And if so, wouldn't clean energy production, although seemingly more costly (in the short term), be a cure for many economies' ailments in the long run?

In Poland, as in other European countries, such a huge undertaking, as the change of the energy system, is a logistical challenge, being a consequence of the implementation of the climate and energy policy by the European Union (EU) in the timeframe covering the period until 2050. In the Polish reality, the terms of change, for the next several years, were adopted on February 2, 2021, under the slogan: "Energy Policy of Poland until 2040" (PEP 2040). Let us therefore pose two theses, relevant to the title considerations, without which there would be no above-mentioned changes. It is no secret that:

- *the energy transition requires, on the one hand, the involvement, but, on the other hand, the support of the society as a whole* (Thesis 1).

For the implementation of change, the aforementioned public acceptance is of key importance. Secondly, it should be recognized that:

- *changes in the energy sector promote socio-economic development and improve the quality of life of residents* (Thesis 2).

Looking at the above, an important piece of the whole puzzle appears in the background. **It is all about energy generation methods and availability of raw materials.** Indeed, for some time now, this is no longer a local or regional problem. This is a global problem and as such needs to be analyzed, taking into account the issue of environmental pollution.

## **2. Terminological issues in outline: environmental governance vs. ecology, energy policy and decarbonization**

Environmental governance, analyzed within the framework of the so-called ecological economics treated as one of the disciplines of economics worldwide, is to be understood in this article as a target state of developmental change, focusing on such of its conditions that lead to an improved quality of life and more efficient management of resources, combined with the pursuit of strategic goals of an ecological nature. The idea is to eliminate disparities and deformities and avoid environmental and social conflicts. This way of interpreting the concept of environmental governance is consistent with the opinion of B. Zaufal on development (here, sustainable development, of which environmental governance

is a component). He argued that sustainable development had to ensure the natural basis of human existence and bring economic, functional and aesthetic order to our living environment [Zaufal, 1987, p. 27]. It is worth noting that with the new development goals came controversy over the concept itself. It is not true that the new policy model, referred to as sustainable development, is only interested in environmental issues. Therefore, it should be assumed that all dimensions – despite the fact that in the text the author focuses mainly on the environmental view – are equivalent, but within the limits imposed by nature. Accordingly, the environmental Kuznets curve (EKC), which, although it raises many questions and is not treated as a necessary relationship for the implementation of sustainable development economics, is suitable for showing the relationship between environmental degradation and economic development, can be treated here as useful for consideration. Indeed, its analysis shows that there is an increase in the level of pollution during the initial stages of the economic growth (the issue of environmental exploitation can be linked here to the drive to create wealth). This trend changes dramatically once a certain level of income is exceeded (Income Turning Point – ITP), when expenditures on the protection of environment begin to rise. However, using the aforementioned curve, it should not be forgotten that empirical studies prove that EKC works only for certain pollutants. This means that the results cannot be generalized to all pollutants and natural resources.

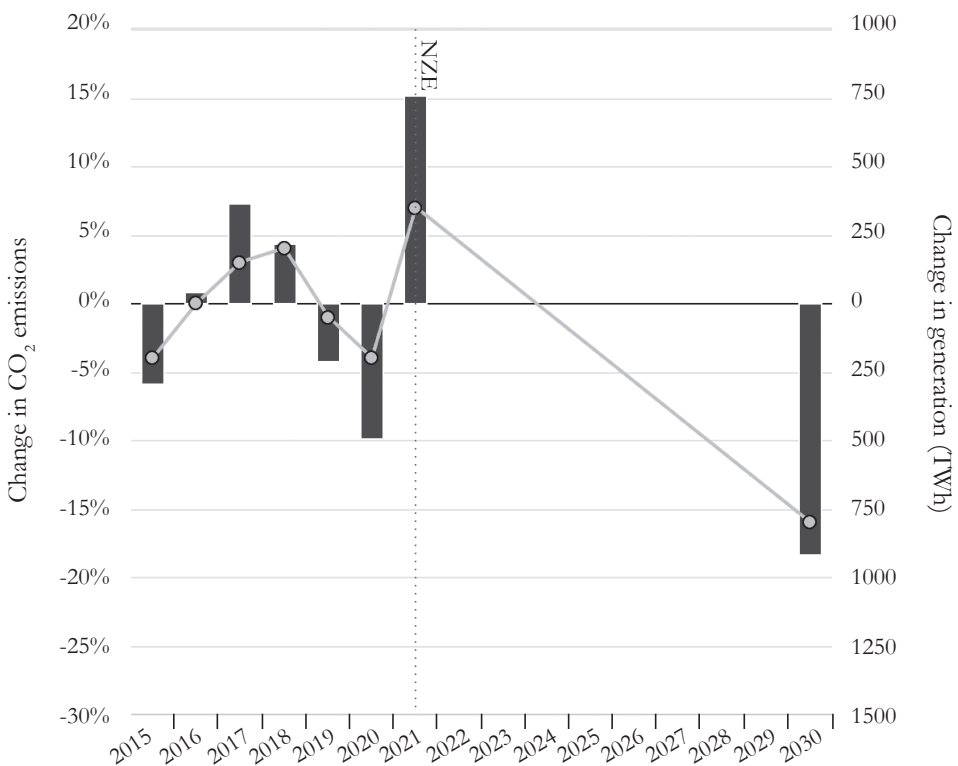
It follows from the above that one of the main problems of the modern world and an integral part of sustainable development policy is environmental protection. The analysis of the figures, included in the IPCC report [2022, p. 213], among others, makes it possible to conclude that in each country (within the capabilities at its disposal), in the face of the needs arising from the Net Zero Energy Systems, there will appear the emergence – much lower than today – of fossil fuel consumption and also the use of alternative energy carriers. This is because it emphasizes using energy more efficiently than at present.

Currently, energy policy, especially in developed countries, is focused on the problem of climate change. Recently, the discussion about the best institutional framework necessary to achieve the assumed goals and the role the state should play has intensified again. Experts wonder whether the state should seek to plan the future shape of energy supplies, energy technologies and fuels used, or focus on creating a legal framework for the operation of the market, with the aim of protecting the end consumer. Energy policy, and to be precise climate-energy policy, represents primarily a long-term vision of moving towards climate neutrality by 2050. Meeting the 2030 climate and energy targets across the EU is crucial

for a low-carbon energy transition. In December 2020, the European Council, in relation to the pursuit of decarbonization of the entire EU, approved a binding EU target to reduce net greenhouse gas emissions by at least 55% by 2030 (compared to 1990 levels). This increased the previously applicable 40% reduction target (Chart 1). Pursuing this goal is as important for the EU as a whole as it is for each member individually. However, it is important to keep in mind the different national conditions of member states and the need to guarantee energy security in each of them separately [www1]. In Poland, according to the Energy Law Act, energy security means the state of the economy that makes it possible to meet the current and prospective demand of consumers for fuels and energy in a technically and economically reasonable manner, while maintaining the requirements of environmental protection.

**CHART 1**

**Annual change in CO<sub>2</sub> emissions from coal-fired power plants in the Net Zero Scenario, 2015–2030**



Source: [www 2].

Two key aspects of coal use and consumption in the economy emerge in the broad energy policy framework, which are indirectly linked to the statistics. Firstly, the need for support in sectors where the loss of employment is inevitable (and will continue to be) (this is primarily the fossil fuel sector) on the one hand, but also the continued provision of access to electricity – on the other (funding investment in new technologies) – are becoming apparent. However, from the environmental point of view, three more key issues should be brought up. Electricity generation should be considered through the prism of the possible; waste of raw materials; (in view of the global energy crisis) and competition for carriers if their supply is insufficient. Thus, the issue of building wind farms and creating jobs in this sector or nuclear power plants<sup>2</sup> appears in the background. Finally, the aspect of environmental pollution cannot be overlooked. From the point of view of ecosystem cleanliness, an analysis of the state of the environment could be made using figures concerning for example:

1. 'zero-emission standards' for buildings and their modernization in terms of resistance to weather conditions,
2. the number of electrically controlled heat pumps,
3. noise levels and
4. air quality.

In the following section, the author, focusing on the “decarbonization” mentioned in the title, taking into consideration air quality, will refer to two issues: energy production and the share of fossil fuels in it. This is because the choice of energy production methods and the raw materials used in the process is of the greatest importance for the green economy. What is more, a recent increase in prices of the three basic energy resources, coupled with huge shortages, have revived the interest in nuclear power, both in Poland and other countries around the world. Therefore, it is necessary to verify whether the statistics confirm the decline in interest in fossil fuels.

### **3. Coal consumption in the world and in Poland**

In recent years, the world's total coal consumption has been significantly affected by the COVID-19 pandemic. According to the IEA report, [IEA, 2022, p. 10],

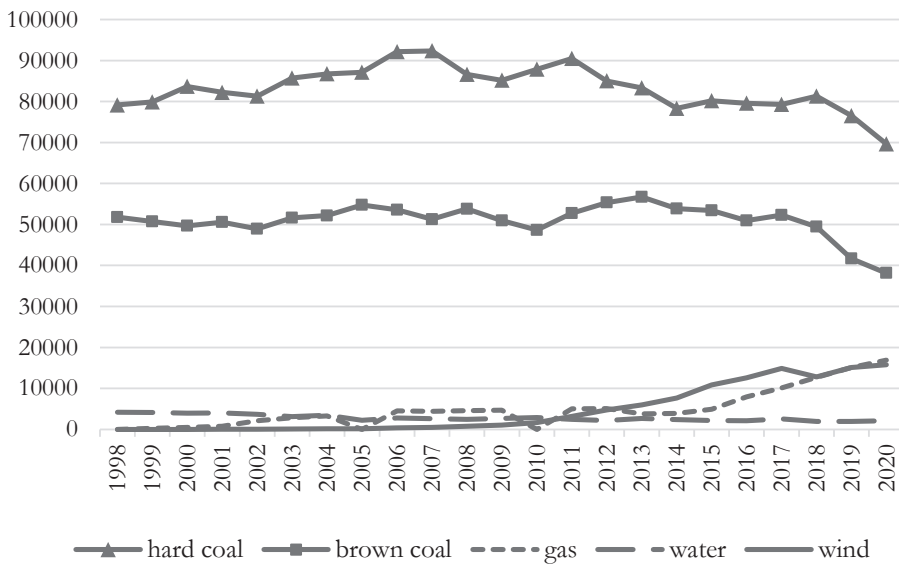
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<sup>2</sup> According to the Energy Policy until 2040, the first nuclear unit, with a capacity of 1–1.6 GW, is scheduled to be launched in 2033, with subsequent units being launched every 2–3 years – and the entire nuclear program assumes the construction of 6 units by 2043.

due to the COVID-19 pandemic, it decreased by 4.4% in 2020, to 7,456 million tons. Coal consumption for power generation decreased by 4.2% due to lower electricity consumption (-0.5%). There has been an increase in renewable energy generation and a decrease in gas prices. The economic slowdown observed during the pandemic resulted also in lower coal consumption in non-energy sectors (-5.4%). In terms of location, the largest relative declines in coal consumption occurred in the United States (18%/-96 million tons) and the European Union (-19%/-93 million tons). In other major coal-using countries, decreases in coal consumption were smaller, e.g. India (-8%/-83 Mt), Russia (-6%/-15 Mt) and South Africa (-8%/-15 Mt). In China, considered to be the world's main coal consumer, coal consumption – as one might guess – increased slightly, i.e. a 0.5% increase (+21 million tons) was recorded.

CHART 2

### Electricity production in utility power plants in Poland [in GWh] after 1998



Source: author's own elaboration based on: [Agencja Rynku Energii S.A., 2016; Agencja Rynku Energii S.A., 2018; Agencja Rynku Energii S.A., 2019; Agencja Rynku Energii S.A., 2021].

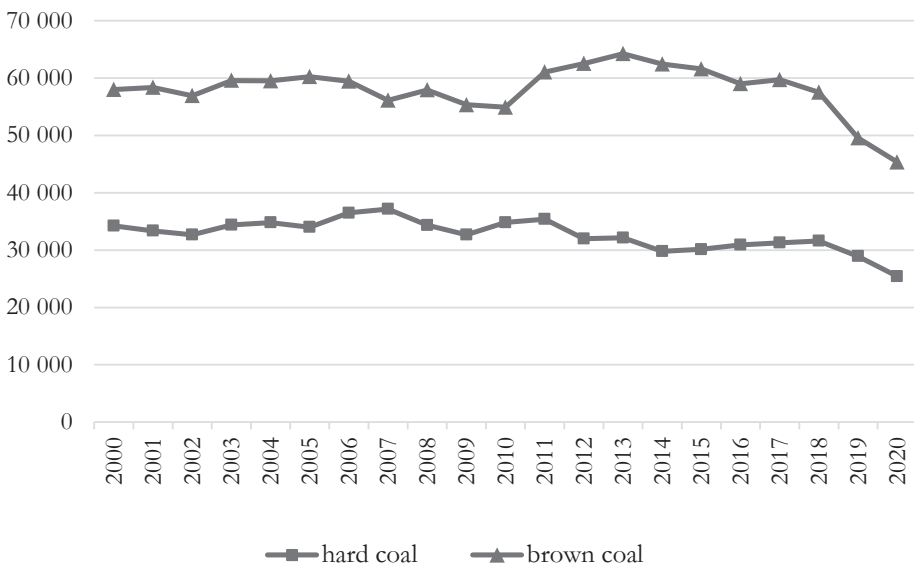
The question arises, however, about the state of things before the pandemic. Was it possible to observe a lesser use of coal for electricity generation at that time as well? And is it already possible to talk about a downward trend?

The non-energy sector generates far fewer negative environmental externalities, that is why electricity production data are extremely important for consideration.

In Poland, according to the available data, the decline in coal consumption (both hard coal and brown coal) became particularly apparent after 2007, with a concomitant increase in energy production from RES, starting in 2010. For example, wind power plants produced 14,136 GWh more energy in 2020 than in 2010 and gas-fired plants produced 12,001 GWh more energy. After 2015, when the Act on Renewable Energy Sources was published on February 20, although year-on-year energy production from all sources combined increased, the share of coal consumed for this purpose declined in favor of other carriers (Chart 2). Among the three energy carriers, water had the smallest share in the period under review. Gas and wind power plants produced comparable amounts of energy after 2015. For example, in 2019, gas-fired power plants produced 15,131 GWh, and wind power plants – 15,107 GWh.

**CHART 3**

**Consumption of hard coal, brown coal for electricity generation in Poland since 2000 [in thousand tons]**



Source: author's own elaboration based on: [Agencja Rynku Energii S.A., 2016; Agencja Rynku Energii S.A., 2018; Agencja Rynku Energii S.A., 2019; Agencja Rynku Energii S.A., 2021].



**TABLE 1**

**Consumption of hard coal, brown coal [in thousand tones] and natural gas [in thousand m<sup>3</sup>] for electricity generation in Poland since 2000**

Year	hard coal	brown coal	Natural gas
2000	34,247	58,002	735,149
2001	33,354	58,348	831,951*
2002	32,668	56,905	991,415*
2003	34,389	59,576	1,186,101*
2004	34,793	59,508	1,192,262*
2005	33,989	60,246	1,469,864*
2006	36,490	59,429	1,216 423*
2007	37,138	56,114	1,214,361*
2008	34,350	57,939	1,852,119*
2009	32,671	55,347	1,859,086*
2010	34,835	54,916	835,766
2011	35,375	61,056	874,337
2012	31,971	62,513	960,538
2013	32,156	64,245	786,096
2014	29,795	62,429	722,035
2015	30,136	61,603	947,597
2016	30,894	59,017	1,042,871
2017	31,274	59,719	1,113,978
2018	31,594	57,508	1,107,126
2019	28,920	49,551	1,193,012
2020	25,407	45,357	1,441,583

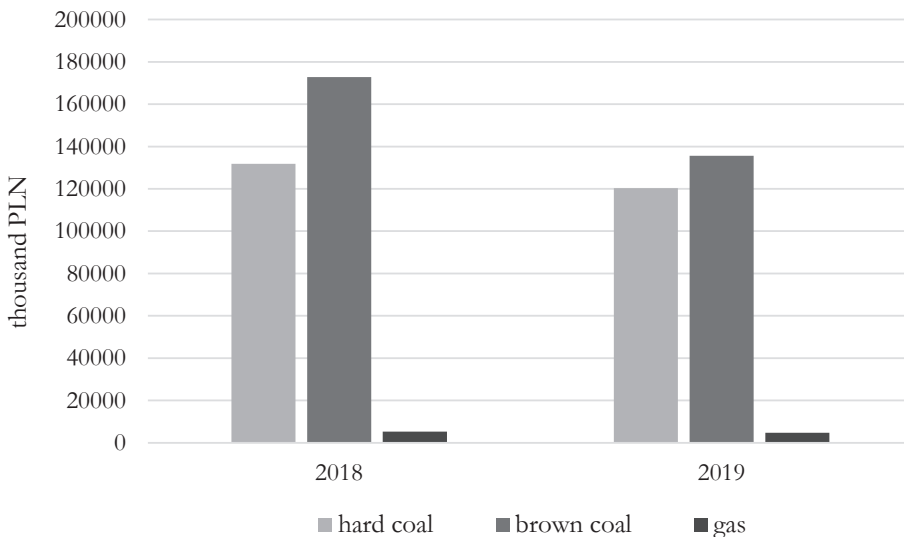
\* total gas fuels (including low-energy gas)

Source: [Agencja Rynku Energii S.A., 2016; Agencja Rynku Energii S.A., 2018; Agencja Rynku Energii S.A., 2019; Agencja Rynku Energii S.A., 2021].

The decline in the share of coal (hard and brown coal) in the energy production process is confirmed by the data provided each year by the Energy Market Agency, on the basis of which Chart 3 was prepared. Table 1, on the other hand, presents data indicating that energy production in Poland is taking place with an increasing share of another carrier not yet analyzed, natural gas (given in thousand m<sup>3</sup>). Certainly, such production is less harmful for the environment, but with the specific goals of PEP2040 in mind (goal 1: Optimal use of one's own energy resources) there occurs the issue of the lack of this raw material in the country and the need to import it. The need to cover demand with imported raw material generates additional, non-environmental costs. The latter, relevant from the point of view of environmental governance, with a breakdown for 2018 and 2019 are presented in Chart 4 and 5.

**CHART 4**

**Total environmental fees and penalties on power plants and combined heat and power plants in Poland in 2018 and 2019 in thousands of PLN, divided by energy carrier**



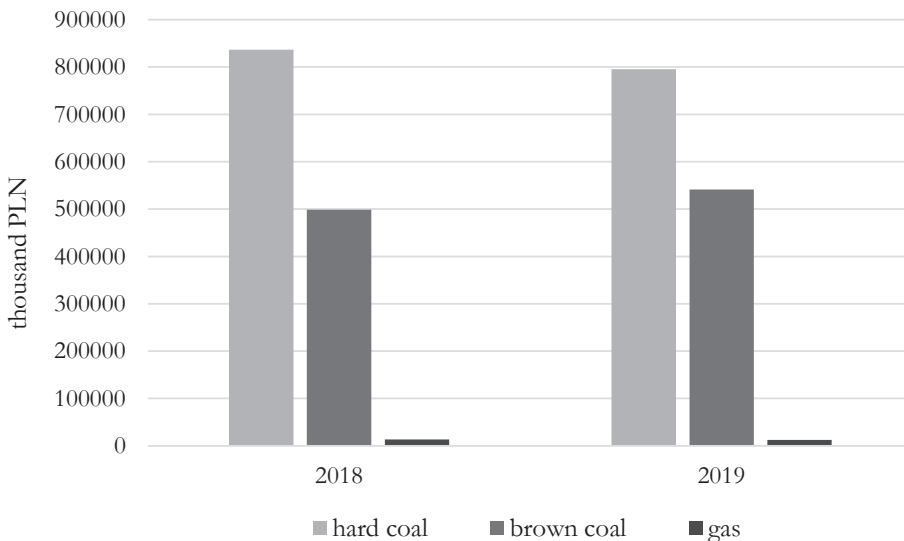
Source: author's own elaboration based on: [EMITOR, 2020, p. 27].

There is no doubt that the costs associated with the use of the environment are important in the decision-making process, i.e. in the implementation of sustainable energy policies. Therefore, it should be noted that the figures clearly show the relationship between coal consumption for energy production and their

level. The decrease in coal consumption, as shown, also resulted in lower costs and fewer environmental penalties (Chart 4). At the same time, the cost of operating environmental protection devices and landfill facilities ranked quite high. Also, an increase in the cost of operating and storing waste at brown coal power plants and combined heat and power plants was noted, in the years indicated (Chart 5).

CHART 5

**Total costs of operating environmental protection devices and waste storage facilities at power plants and combined heat and power plants in Poland in 2018 and 2019 in thousands of PLN, divided by energy carrier**



Source: author's own elaboration based on: [EMITOR, 2020, p. 27].

#### 4. Conclusions

The purpose of the article was to determine whether decarbonization is an alternative or a necessity. In view of the current problems with coal supplies on the one hand, and the need to take care of the environment on the other, posing this question is justified. The analysis showed that with the need to meet the EU's climate and energy targets by 2050 and the need to implement an energy union and build a single EU energy market, further changes in the energy sector

are inevitable. The current energy policy of the member countries, which include Poland, is geared towards the pursuit of climate neutrality. This state of affairs stems from the strategy adopted by the European Commission in 2019 (refers to the Communication on the European Green Deal). In Poland, this requires the implementation of three pillars (Table 2).

TABLE 2

**Three pillars of energy transition in Poland in line with PEP2040**

<i>First pillar</i> Fair transformation	<i>Second pillar</i> Zero-emission energy system	<i>Third pillar</i> Good air quality
Transformation of coal regions	Offshore wind energy	Transformation of the heating industry
Limitation of energy poverty	Nuclear energy	Electrification of transport
New industries connected with RES and nuclear energy	Local and civic energy	'Dom z Klimatem' project

Source: author's own elaboration based on: [www 1, p. 6].

Through the implementation of the goals and actions indicated in PEP2040, a low-carbon energy transition is planned, with an active role for the end user and the involvement of domestic industry. On the economic side, it is planned to ensure energy security, in an innovative and socially acceptable way with respect for the environment and the climate. This is to be achieved, among others, by further reducing the share of coal in the power generation process.

Thus, decarbonization is desirable and, according to the data, highly recommended. This is supported by economic and environmental considerations. Nevertheless, this means investing in alternative generation methods, including the construction of nuclear power plants or more wind farms. Only the maintenance of the necessary, from the point of view of the needs of the economy, volume of energy is a guarantee of its further development. As for the costs, it has been estimated that the energy transition, based on decarbonization, will require the involvement of many players and significant investment expenditure, the scale of which in 2021–2040 may reach about PLN 1,600 billion [www 1]. Data presented in 2021 by the Ministry of Climate and Environment showed that investments in the fuel and energy sectors will involve funds of about PLN 867–890 billion. The

projected expenditure in the electricity generation sector will reach approx. PLN 320–342 billion, of which about 80% will be allocated to emission-free capacity, i.e. RES and nuclear power. These calculations are, of course, subject to change, as they depend on the current economic and political situation in the country and the world. It will only be possible to talk about the success of change when, as H. Rogall wrote, the mindset of the global society changes.

## References

- Act dated April 10, 1997 – Energy Law (Journal of Laws of 2021, item 716) as amended.
- Agencja Rynku Energii S.A., 2016, *Statystyka Elektroenergetyki Polskiej 2015*, Warszawa.
- Agencja Rynku Energii S.A., 2018, *Statystyka Elektroenergetyki Polskiej 2017*, Warszawa.
- Agencja Rynku Energii S.A., 2019, *Statystyka Elektroenergetyki Polskiej 2018*, Warszawa.
- Agencja Rynku Energii S.A., 2021, *Statystyka Elektroenergetyki Polskiej 2020*, Warszawa.
- EMITOR 2020, *Emisja Zanieczyszczeń Środowiska w Elektrowniach i Elektrociepłowniach Zawodowych*, Agencja Rynku Energii S.A., Warszawa.
- IEA, 2022, *Coal 2021: Analysis and forecast to 2024*, OECD Publishing, Paris, DOI: 10.1787/ba0095c1-en [date of access: 20.06.2022].
- IPCC, 2022: *Climate Change 2022: Mitigation of Climate Change. Working Group III Contribution to the IPCC Sixth Assessment Report*, <https://www.ipcc.ch/report/ar6/wg3> [date of access: 29.06.2022].
- Jankowska E., 2016, *Środowiskowa krzywa Kuznetsa w dekarbonizacji Europejskich Gospodarek*, “Studia Ekonomiczne. Zeszyty Naukowe Uniwersytetu Ekonomicznego w Katowicach”, No. 289, pp. 51–61.
- Orłowski W.M., 2022, *Ekonomia dla ciekawych czyli co zeznał porwany profesor*, Dom Wydawniczy Rebis, Poznań.
- Rogall H., 2010, *Ekonomia zrównoważonego rozwoju. Teoria i praktyka*, Wydawnictwo Zysk i S-ka, Poznań.
- Welzer H., 2008, *Klimakriege – Wofür im 21. Jahrhundert getötet wird*, S. Fischer Verlag, Frankfurt a.M.
- Zaufal B., 1987, *O potrzebach kodeksu ekorozwoju*, “Aura”, No. 12.
- www 1, *Polityka energetyczna Polski do 2040 r.*, <https://www.gov.pl/web/klimat/polityka-energetyczna-polski> [date of access: 29.06.2022].
- www 2, <https://www.iea.org/reports/coal-fired-electricity> [date of access: 29.06.2022].

