

GREEN TRANSITION IN POLAND – OPPORTUNITIES AND THREATS

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Purpose: The objective of this article is to identify the opportunities and threats that have emerged as a result of the energy transition process in Poland, with a particular focus on the economic implications of the measures that have been implemented. The analysis commences with a theoretical considerations of the identification and categorisation of the objectives of the European Union's climate and energy policy, together with an investigation of their environmental and economic consequences for Poland.

Design/methodology/approach: The article employs a critical analysis of the existing literature on the subject, later used to conduct a SWOT analysis for the purpose of identifying potential opportunities and threats to the current transformation processes in the energy sector in Poland. The research problem was also analysed and synthesised using the aforementioned investigative and synthesis method.

Findings: The key finding of the study is that the energy sector in Poland is not appropriately prepared to accommodate such wide changes which are going to be certainly brought about the energy transition process. The restructuring of the existing energy mix is contingent upon substantial financial commitments, which Poland is currently not prepared to undertake. Furthermore, the implementation of the assumptions of energy system transformation requires the allocation of financial resources between the sectors of the national budget.

Originality/value: The consideration carried out constitute the author's assessment of the opportunities and threats to the assumptions of the energy transition in Poland carried out on the basis of SWOT analysis. The article is directed towards all the individuals involved in the resolution of this issue. The secondary objective is to present a realistic evaluation of the assumptions underlying the energy transition in Poland.

Keywords: energy transition; electrical power engineering sector; SWOT analysis.

Category of the paper: research paper.

1. Introduction

One of the European Union's primary objectives in the area of climate and energy policy is to reduce the proportion of conventional energy resources in the energy mix. For a significant number of countries within the European Union, including Poland, the necessity arises for the implementation of a low-carbon or, ideally, a zero-carbon economy that is largely independent of fossil fuels. The process, referred to as the energy transition or green transition, presents significant challenges for the electricity sector in Poland, which currently relies on fossil fuels. Lignite, hard coal and natural gas are the key energy resources for the Polish electricity market. A significant reduction in the proportion of energy derived from non-renewable sources in favour of renewable energy sources is a challenging, time-consuming and, most importantly, expensive process. This leads to the question of whether Poland is capable of meeting the demands placed upon it, and what the resulting consequences may be.

The objective of this article is to identify the opportunities and threats that have emerged as a result of the energy transition process in Poland, with a particular focus on the economic implications of the measures that have been implemented. The analysis commences with a theoretical considerations of the identification and categorisation of the objectives of the European Union's climate and energy policy, together with an investigation of their environmental and economic consequences for Poland.

1.1. The fundamental principles and objectives of the European Union's climate policy

The issue of global climate change and the associated need for restructuring the energy sectors of countries within the European Union and beyond has been the subject of extensive research, analysis and discussion for an extended period of time. The continuing phenomenon of globalisation, accompanied by ongoing technological advances is influencing a number of factors, including the increase in demand for electricity or global climate change. A significant challenge in the context of energy demand is the question of how energy is sourced and produced. Indeed, in the majority of economic contexts, similarly to Poland, the primary raw material used for the generation of electricity are lignite and hard coal, which are classified as conventional energy sources. The utilisation of these resources has the unintended consequence of contributing to an increase in carbon dioxide emissions (CO₂), which has been recognised by the European Commission as an adverse phenomenon requiring 'immediate' intervention. For this reason, since 2008 the European Commission has been adopting series of documents pertaining to the measures to be taken with regard to the European Union's energy and climate policy. The initial package of climate and energy measures, designated as the 20-20-20 targets, was enacted in 2008, with targets set until 2020 (Commission of the European Communities, 2008). In turn, 2014, the preceding assumptions were revised and a package of measures up to 2030 was adopted (Commission of the European Communities, 2014a, 2014b). In summary, the principal objectives of the European Union's energy and climate policy include:

- the reduction of gas emissions by 20% by 2020 and by at least 40% by 2030 (relative to levels observed in 1990),
- increasing the proportion of renewable energy in the EU's total energy consumption to 20% by 2020 and to ensure that the share reaches at least 27% by 2030,
- achieving a 20% increase in energy efficiency by 2020 and a minimum of 27% by 2030.

In addition, long-term objectives have been established for the following areas:

- transitioning to a competitive, low-carbon economy by 2050 – in accordance with the assumptions entailing reducing emissions by 80% (compared to 1990 levels) through reducing domestic emissions (Commission of the European Communities, 2011) and
- establishing a sustainable, competitive and secure energy system by 2050, through the implementation of enhanced energy efficiency, augmented renewable energy, nuclear energy and carbon capture and storage (Commission of the European Communities, 2014b).

In order to reduce greenhouse gas emissions, the European Commission proposed the establishment of the European Emissions Trading System (EU ETS), which was implemented in 2003 (Commission of the European Communities, 2003). The objective of this system is to regulate the emission of greenhouse gases by energy-intensive industries, energy producers, airlines, road and maritime transport (*Ustawa z Dnia 12 Czerwca 2015 r...*, 2015). This concerns mainly emissions of gases such as carbon dioxide (CO₂), nitrous oxide (N₂O), perfluorocarbons (PFCs) from large power plants and industrial installations and air transport. The ETS establishes a ceiling on the emission allowances that companies are permitted to purchase or receive. The issue is that the cost of these allowances remains relatively high, at approximately EUR 80 per tonne. However, in recent years, prices have reached record highs of EUR 100/tonne (approximately EUR 50/tonne in early 2021 and EUR 24/tonne in early 2020), which was undoubtedly influenced by Russia's aggressive behaviour in the European energy market and military action in Ukraine (Polski Komitet Energii Elektrycznej, 2022).

A further objective of the European Union's energy and climate policy is to increase the proportion of renewable energy sources in the energy sectors of the Member States. The scope of permissible action in this area varies from one country to another and is defined by the binding national targets that have been set. The quantity of the share to be established is contingent upon the advancement of renewable energy solutions and the country's capacity to increase it. Each Member State was obliged to delineate the manner in which it would fulfil its obligations. The advancement of these initiatives is evaluated on a biennial basis and documented in pertinent reports. Nevertheless, the European Commission has not neglected the sector of renewable energy sources, aiming to accelerate progress towards the 2030 energy and climate policy target of increasing the share of renewable energy sources (RES) in the energy mix to 27%, the Commission has developed a number of supporting measures. These include – among others – financial support schemes, restrictions on the level of energy consumption or

district heating and cooling systems, rules for cross-border cooperation, administrative simplification and greenhouse gas emission limits for biofuels.

In addition to the aforementioned objectives, the European Union's energy and climate policy also aims to enhance the energy efficiency of its Member States. This primarily concerns the commitment of these countries to more efficient energy use, beginning with the production, distribution and final consumption of energy. The realisation of this objective necessitates – among others – a number of amendments to existing legislation, as well as the allocation of significant financial resources for implementation. The energy union, established in 2015 aims to provide support for energy efficiency improvements, its objective is to (Commission of the European Communities, 2015):

- diversify European energy sources, ensuring energy security through the fostering of solidarity and cooperation between European Union Member States;
- ensure the optimal functioning of a fully integrated internal energy market, which enables the free flow of energy within the European Union through the implementation of appropriate infrastructure and without technical and regulatory barriers;
- enhance energy efficiency and diminish reliance on imported energy sources, while concurrently reducing emissions and stimulating job creation and economic growth,
- decarbonise the economy and transition to a low-carbon economy in accordance with the Paris Agreement,
- promote research in low-carbon and clean energy technologies, with a particular priority on research and innovation which facilitate the energy transition and enhance competitiveness.

All Member States, including Poland, are obliged to implement the aforementioned objectives of the European Union's energy and climate policy. For this reason, the subsequent section will present a synthetic characterisation of the condition of the energy sector in Poland in light of the ongoing energy transition process.

1.2. Energy transition in Poland

As previously stated, one of the primary objectives of the European Union's energy and climate policy is the decarbonisation of the energy sectors of its member states. Nevertheless, the Polish energy sector will continue to rely on coal, including both hard coal and lignite, for the foreseeable future. This assertion is proven by the data presented in Figure 1, which demonstrates that the general share of energy generated by conventional power plants in 2022 was 72.4%, out of which 69.1% was derived from the combustion of coal and lignite, while 3.3% was derived from the combustion of natural gas. The remaining 27.6% is accounted for by renewable energy sources, including wind power, photovoltaics and other similar technologies.

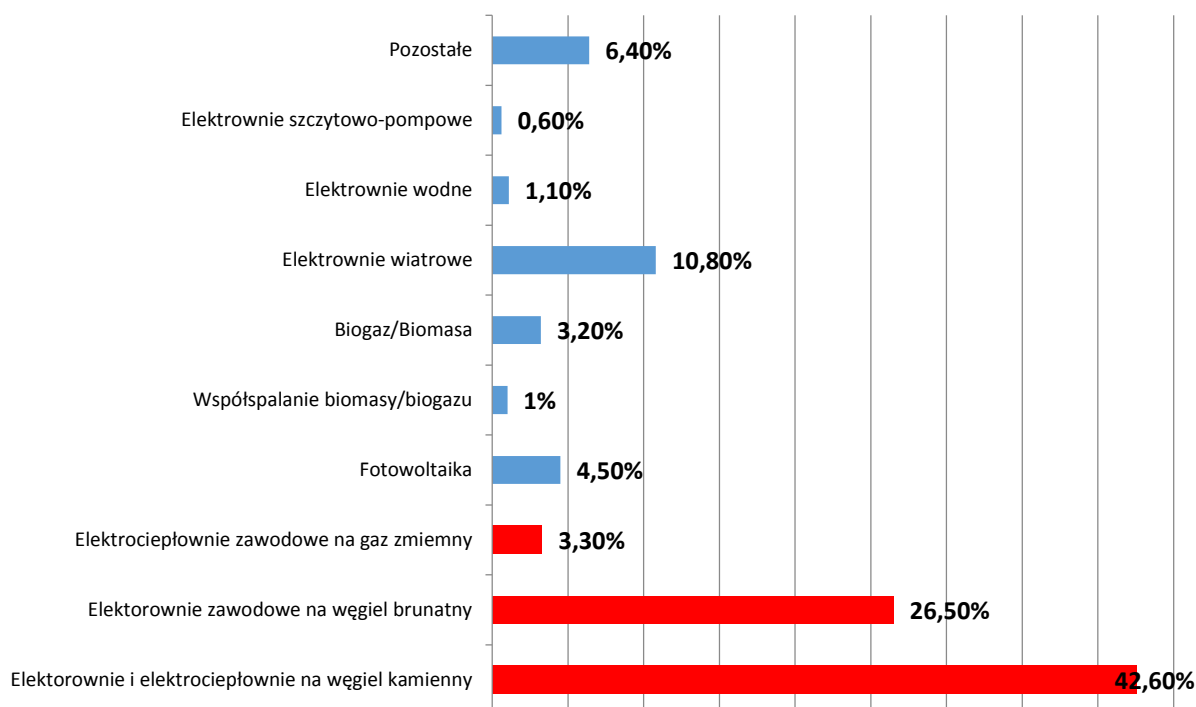


Figure 1. Structure of electricity production in Poland (January-December 2022).

Source: Own elaboration based on data from the Energy Market Agency's Statistical Information on Electricity, No. 12(348), December 2022.

The structure of electricity production in Poland presented in Figure 1 demonstrates that the role of conventional energy resources play a key role in the Polish energy sector while, abandoning these resources entirely would present a significant challenge to Poland's energy security. Conversely, however, these raw materials are at risk of depletion, which is why the Polish energy sector requires significant and far-reaching changes towards the decarbonisation of electricity production. Unfortunately, this comes at a high cost.

The stated objective is therefore to establish a low-carbon and sustainable energy sector, powered by renewable energy sources. These measures are aligned with the aforementioned objectives of the European Union's climate and energy policy, which is why Poland has assumed the responsibility of enhancing energy efficiency in order to adapt to the requirements imposed by the European Union carrying out a process of transformation of its own energy sector. It is important to note that condition of the infrastructure of the Polish energy sector and the country's reliance on coal, particularly hard coal and lignite requires Poland to overcome a number of difficulties, primarily economic and financial, in order to achieve its goals, set by the European Union. The transformation process of this sector should consider Poland's initial position, its socio-economic circumstances, and the equitable distribution of the costs associated with the implementation of the proposed solutions (Ministerstwo Klimatu i Środowiska, 2021). The economic aspect is going to be the key to the success of the transformation processes. The implementation of the adopted measures necessitates considerable investments where the EU's contribution is of key importance. Simultaneously,

investment decisions must consider the implications of green and low-carbon recovery in order to maintain socially acceptable energy prices. The projected financial outlays for the restructuring of the Polish energy sector between 2021 and 2040 is estimated at approximately PLN 1.6 billion. It is estimated that the fuel and energy sectors will receive approximately PLN 867-890 billion in funding, while projected investments in the electricity generation sector are expected to reach around PLN 320-342 billion, out of this amount, approximately 80% is going to be assigned for the development of capacities such as renewable energy sources and nuclear power (Ministerstwo Klimatu i Środowiska, 2021). The real prospect of rising energy costs represents a significant threat to the ongoing changes in the fuel and energy sector. Financial support, both operational and related to investment resources, will be instrumental in accelerating the implementation of the proposed changes allowing for their implementation in the shortest possible time and on the most extensive scale possible. It is also important that the manner in which the transition is executed incorporates socially acceptable energy prices, while simultaneously preventing the exacerbation of energy poverty. This, in turn, constitutes a distinct issue that evokes considerable negative sentiment and controversy within society.

The strategic document titled Energy Policy of Poland until 2040 (EPP2040) delineates the scope of transformational activities that Poland plans to implement in the period leading up to 2040 (Ministerstwo Klimatu i Środowiska, 2021). The document considers the difficulties of harmonising the national economy with the European Union's regulations on the 2030 climate and energy targets, the European Green Deal, the recovery plan after COVID pandemic and the drive towards climate neutrality. EPP2040 is consistent with the National Energy and Climate Plan for the years 2021-2030, offering a comprehensive account of the current state and circumstances of the energy sector. EPP2040 consists of three fundamental pillars containing eight detailed objectives (these objectives will be considered in detail in the subsequent part), along with the actions and strategic projects required for their implementation as well as strategic projects. Furthermore, the document delineates the territorial scope and identifies the sources of funding. The legislative objective of Poland's energy policy is to guarantee energy security while simultaneously maintaining and enhancing the competitiveness of the national economy, promoting energy efficiency, and reducing the adverse environmental impact of the energy sector. The first pillar of EPP2040 regards just transition. This entails the transformation of the regions most adversely affected by the low-carbon energy transition, with the objective of creating new development and employment opportunities. The second pillar is an emission-free energy system. The deployment of nuclear and wind power, in addition to the increased role of distributed energy installations, including those set up by households and industrial centres, will play a significant role in this regard. The final – third pillar – good air quality, is concerned on the allocation of resources towards the transformation of the systemic and individual heating sector, the electrification of transport, and the promotion of contemporary solutions in the form of passive and zero-emission houses that utilise local energy sources.

In conclusion, EPP2040 describes the fundamental tenets of Poland's energy transformation, delineates the primary objective of the country's energy policy, such as ensuring energy security, enhancing the competitiveness of the economy, promoting energy efficiency and mitigating the environmental impact of the energy sector and elucidates specific objectives encompassing the entire energy sector, from the acquisition of raw materials to their utilisation and sale of energy. The three pillars of the energy transition set out by Energy Policy of Poland until 2040 provide a framework for the country's energy transition, outlining the direction in which it should proceed while establishing fair rules for achieving a zero-carbon Polish energy sector while ensuring energy security. It is thus recommended that the efficacy of the proposed transformational solutions be evaluated in light of the opportunities and threats they present, which represents the primary objective of this paper. The third section of this paper presents the findings of the analysis and offer an evaluation thereof.

2. Methods

As mentioned, the objective of this article is to identify the opportunities and threats that have emerged as a result of the energy transition process in Poland, with a particular focus on the economic implications of the measures that have been implemented. The implementation of the objective formulated in such manner necessitated the utilisation of research methods, including the method of literature analysis and criticism, the method of analysis and logical construction, SWOT analysis (i.e. strengths, weaknesses, opportunities, threats) and inference. The article's analysis of the opportunities and threats inherent in Poland's energy sector transformation processes required a comprehensive review of documents, reports, and legal instruments at both the EU and national levels. A critical analysis of the literature in this area enabled the identification of opportunities emerging from changes in the Polish energy sector. In contrast, the utilisation of the analytical method and logical construction facilitated the identification of the key risks. The combination of both methods has enabled the execution of a SWOT analysis of the green transition in Poland. This analysis formed the basis for answering the question of whether the energy transition in Poland presents opportunities for the modernisation of this sector of the Polish economy, or whether it will instead give rise to intractable problems and difficulties. In the adopted approach, it is crucial to focus the analysis on the energy sector in Poland and the SWOT analysis was limited to the identification and assessment of opportunities and threats to the assumptions and expected results of the transformation processes. The utilisation of the inference method enabled the results of the research to be evaluated and commented upon.

The subsequent section of this paper will present the problem under discussion in tabular form, accompanied by appropriate commentary and conclusions.

3. Results

As previously stated, the fundamental objective of the energy transition, otherwise known as the green transition, is to establish a sustainable, low-carbon economy that is based on renewable energy sources and environmental protection. Given the current level of knowledge and technological capabilities, this appears to be a realistic and achievable goal. Nevertheless, concerns pertaining to this matter are intensified by the fixed temporal framework, delineated by the deadlines stemming from the stipulations of the package documents, the European Green Deal, and Fit for 55.

The European Green Deal is a set of policy initiatives from the European Commission, which was announced in December 2019 in a Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions titled *European Green Deal* (Commission of the European Communities, 2019). Its main objectives include:

- reducing EU greenhouse gas emissions by 55% by 2030 in comparison to 1990, with the ultimate goal of achieving climate neutrality by 2050,
- decoupling economic growth from the amount of consumed resources,
- achieving a state of equilibrium in the level of development of all European regions.

These assumptions seemed to be realistic for Poland to achieve through effective collaboration between the energy and political sectors. The reasonably planned timeframe for the implementation of the adopted assumptions did not present a significant challenge in achieving the aforementioned objectives. Nevertheless, the European Union has recently set forth a new objective – to reinforce its status as a global leader in the energy and climate markets. Consequently, in 2020, the European Council endorsed a revised objective to curtail greenhouse gas emissions by a minimum of 55% by 2030 in comparison to 1990 levels by the introduction of the Fit for 55 Package in 2021. The recently adopted regulations have notably intensified and expedited the assumptions set forth in the European Green Deal for 2030. The assumptions made in the Fit for 55 package cover a range of areas, including modifications to district heating and cogeneration, land use and forestry, the road transport sector, and energy taxation. This package includes changes mainly to:

- emissions trading scheme,
- Effort Sharing Regulation,
- CO₂ emission standards for cars and vans,
- Renewable Energy Directive,
- Energy Efficiency Directive,
- Regulation on land use, land use change, and forestry,
- Energy Taxation Directive

as well as the introduction of a new CO₂ border price adjustment mechanism. The recently introduced regulatory framework has considerably intensified and, furthermore, hastened the energy transition procedures across the member states. Some countries, such as Poland, are confronted with significant challenges in implementing the legislative changes required by the Fit for 55 package, as the complexity of the legislative processes, the lack of financial resources, and the necessity to implement changes that have already been imposed all contribute to making the assumptions of the package nearly impossible to fulfil within the limited timeframe. This led to the decision to conduct a SWOT analysis of the opportunities and threats associated with the green transition in Poland. The results of this analysis are presented in Table 1.

Table 1.

SWOT analysis – opportunities and threats of the green transition in Poland

	Opportunities (O)	Threats (T)
Energy efficiency	<ul style="list-style-type: none"> • a reduction in greenhouse gas emissions, • decarbonising the economy and transition to a low-carbon economy in accordance with the Paris Agreement, • a reduction in energy consumption in production facilities, • more efficient and less carbon-intensive energy and heating solutions, • more efficient and less carbon-intensive extraction of hydrocarbons 	<ul style="list-style-type: none"> • the absence of regulatory frameworks that would facilitate expeditious investment in energy sources that can achieve the targeted reduction of greenhouse gases (by at least 55% by 2030 in comparison to 1990), • a reform of the energy tax system, entailing the removal of exemptions and the reduction of rates that encourage the use of fossil fuels, • changes to CO₂ (EU ETS) emissions trading, including: an increase in the price of CO₂ allowances, a reduction in the overall emissions cap and an increase in the annual rate of reduction, and the abolition of free allowances for aviation, • an increase in the level of effort-sharing reduction values
Energy sources	<ul style="list-style-type: none"> • diversification of energy sources, • greater own energy production derived from RES, • greater energy independence through a reduction in the importation of traditional raw materials, • advancement of innovative technologies and the utilisation of nuclear energy represent pivotal areas of development 	<ul style="list-style-type: none"> • achieving a 40% share of renewable energy sources in total energy production by 2030. • lack of funding for retrofitting electricity grids, • lack of legal regulations in the area of nuclear energy investments
Products and services	<ul style="list-style-type: none"> • the provision of zero- and low-carbon energy sources (including clean electricity, low-carbon heat, renewable hydrogen, biomethane, biofuels, and synthetic fuels), • development of non-energy-intensive products and services, • business diversification based on new technologies (electromobility). 	<ul style="list-style-type: none"> • the advancement of zero-emission mobility after 2035 in the automotive industry, particularly in the category of cars and vans, • the need to enhance the charging capacity of zero-emission vehicles in direct correlation with their sales figures and implementing a comprehensive network of charging and refuelling stations along motorways at regular intervals, • the necessity to renovate 3% of public sector buildings with the objective of reducing energy consumption

Cont. table 1.

Research and development	<ul style="list-style-type: none"> • promote research in low-carbon and clean energy technologies, with a particular priority on research and innovation which facilitate the energy transition and enhance competitiveness 	
Social aspect	<ul style="list-style-type: none"> • stimulating job creation and economic growth 	<ul style="list-style-type: none"> • fear of increasing energy prices, • the lack of financial resources allocated to the modernisation of domestic heating systems, • a concern regarding the potential for a shift in the conditions governing the consumption and uptake of energy produced within the micro-installation of a renewable energy system (RES)
Cooperation with other EU Member States	<ul style="list-style-type: none"> • ensuring the optimal functioning of a fully integrated internal energy market. which enables the free flow of energy within the European Union through the implementation of appropriate infrastructure and without technical and regulatory barriers 	<ul style="list-style-type: none"> • unpredictable events hindering the ability to foster collaboration with both EU and non-EU countries such as COVID-19 pandemic, Russia's aggression against Ukraine

Source: Own elaboration based on: (Ministerstwo Klimatu i Środowiska, 2021).

A critical examination of the principal assumptions underlying the transformation of the energy sector in Poland has revealed that, while the process of change offers numerous opportunities, it also gives rise to a number of risks. It is of the utmost importance to recognise that the Polish energy infrastructure is outdated and not prepared for such significant changes that are currently taking place, in particular, the development of the green energy sector and the construction of short transmission networks powered by renewable energy sources (Moskwa-Bęczkowska, Moskwa, 2022). For years, Poland has been a nation reliant on coal and lignite as its primary energy sources. Therefore, that the production and distribution of energy, and indeed the entire energy infrastructure, have been largely adapted to accommodate these raw materials. While the renewable energy sector has been experiencing robust growth for an extended period, with this growth being both desirable and welcome, the majority of these installations are situated within individual households. In light of these circumstances, Poland is confronted with a challenging and, most notably, an expensive setback, particularly in view of the time limits set by the European Commission. In this context, a significant challenge for Poland may emerge from the potential consequences of failing to achieve the objectives set out in the European Union's climate and energy packages.

The economic and financial aspects are a distinct issue, as Poland lacks the requisite financial resources to implement the full range of climate and energy targets approved by the European Union by 2050. It has been estimated that the energy transformation of Poland, as designed in EPP2040, will require significant investment. This is contingent upon the transformation being carried out in a socially acceptable manner, while guaranteeing energy security, maintaining the competitiveness of the economy and limiting environmental impact. The scale of the investment required is estimated to reach approximately PLN 1600 billion

between 2021 and 2040 (Ministerstwo Klimatu i Środowiska, 2021). The aforementioned funds are – mainly – to be provided as part of an increase in budgetary outlays for the development of the energy sector in Poland. In light of the considerable scale of the planned changes and their associated costs, it is inevitable that national financial resources will prove inadequate in achieving the objectives of the energy transition. It is important to note that the national funds will be allocated through transfers between the sectors of the newly created state budget; this will inevitably result in a reduction of funds in other sectors of the Polish economy. An opportunity for stable development of the sector, made available through external funding under the support schemes and aid programmes on offer, including for example: InvestEU, the Recovery and Resilience Facility, the Life Programme, the Modernisation Fund, without which the energy transition in Poland would not be possible.

4. Summary

As evidenced by the preceding discourse, the process of energy transformation in Poland is both necessary and desirable, offering numerous opportunities for the modernisation of the energy sector – however, it also gives rise to significant doubts and controversies regarding the feasibility of meeting the assumed time limits for implementation and the potential consequences of the implemented solutions. The primary focus is on the comprehensive decarbonisation of the Polish energy sector, which will necessitate the cessation of hard coal and lignite mining, resulting in the closure of numerous industrial facilities. It is indubitable that this will have a deleterious effect on the Polish economy. The considerations presented in this paper represent a preliminary investigation into the author's broader research project, which aims to analyse and evaluate the effects of the energy transition in Poland.

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