THE USE OF BIOFUELS AS AN EXAMPLE SOLUTION TO ENERGY SECURITY CHALLENGES IN POLAND

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Abstract The aim of this article is to critically analyse the problem of expected changes in the field of energy security. The events of the war in Ukraine have brought the issue of energy security management to new levels of business, political and economic considerations. Energy security is most often understood as such a state of the economy that ensures that consumers' demand for fuel and energy is met - economically, technically and socially. Separate studies indicate that the supply of the energy system should be flexible and diverse. Any negative impact of the energy sector must be short-lived, minor and quickly minimized. The ongoing analysis and inference carried out by the authors of this article showed that the EU's intentions and projects, including in Poland, can be disrupted by the fact that each country develops its economy and manages energy in its own way. It was shown that biofuels will be an important element in ensuring Poland's future energy security. On such a basis of research conclusions, a practical implication was derived that, given the assumed costs of the energy transition and the requirements of the "Green Deal," preparatory activities should begin in the country now.

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1 Introduction

Contemporary state economy is not an isolated entity - it is largely dependent on international relations and a network of mutual relations. In this area, the energy stability of the state is one of the most important issues related to its national security. Therefore, the energy market is regulated by governments and is under their strict control (Yering, 2006; Mlynarski, 2011; Trubalska, 2015). Since the dawn of time, the security of energy supply has depended on many factors. Sample statements related to the functioning of the Organization of the Petroleum Exporting Countries (OPEC) and the oil crisis revealed in the 1970s made it clear that energy should be supplied from many sources. It was recognized that any negative impact of the energy sector must be short-lived and quickly minimized. This is the security aspect that must be maintained not only in a given macro-region, but also in each country and its economy (OPEC, 2023).

The war in Ukraine brought the issue of energy security management to new levels of business, political and economic considerations. It highlighted, above all, the need to become independent of Russian fossil fuels through the use of renewable energy sources. On such grounds Ursula Von der Leyen at the World Economic Forum, Davos 2023 announced "the beginning of a revolution in energy security." The meeting was held under the theme "Cooperation in a Divided World," and the basis for deliberations was the "Global Risk Report" (World Economic Forum, 2023). In her speech, the European Commission President noted that the European Union (EU) is approaching a geopolitical shock and an energy crisis, and "the next decade will bring the greatest industrial transformation of our time." She stressed that EU countries were the first in the world to launch the "European Green Deal," which has brought innovative investments in clean technologies in all sectors of the green transition. She made it clear that EU countries must take better care of their own clean technology industries.

The Green Deal industrial plan will thus have four pillars: regulatory environment, financing, skills and trade. The first pillar is about speed and access - the regulatory environment allows for the rapid scaling of operations and the creation of favourable conditions for sectors that are key to achieving the goal. These include wind, heat pumps, solar, clean hydrogen and energy storage. The second pillar deals with increasing financing for energy transition projects and public assistance. The third

pillar of the Green Deal plan is about developing the skills to achieve this transformation. The fourth pillar will address facilitating open and fair trade for the essential supply chain (World Economic Forum, 2023). In light of the above, the attention of all EU member states, including Poland, should shift from primary energy carriers (oil, gas, coal) to renewable ones. One such energy source should be biofuels.

2 Theoretical Background

Energy security is a multifaceted and very dynamic concept. This causes numerous difficulties in defining it. A uniform and common concept of energy security has not been developed so far. In the simplest terms, energy security is the possibility to access energy resources at any time, at an affordable price and guarantee of raw materials supply (Yering, 2006; Trubalska, 2015). The essence of energy security has also been defined by the United Nations as "the availability of energy at any time, in various forms, in sufficient quantities and at a reasonable price" (World Energy Assessment 2000; Elżanowski, 2008). In the Polish legal system, energy security has been defined in the Energy Law Act and is understood as the state of the economy that makes it possible to cover the current and prospective demand of consumers for fuels and energy in a technically and economically justified manner, while maintaining the requirements of environmental protection (Act, 10.04. 1997). In theoretical terms, energy security has two dimensions (Młynarski, 2011): "internal" (balancing demand and supply, taking into consideration the environment, consumers, as well as political and economic requirements) and "external" (filling the gap resulting from the difference between production and domestic needs).

3 Methodology

The purpose of the study was to identify the state and determine the direction of the expected changes in the area of energy security with particular emphasis on Poland. The available literature on the subject and data were used to determine the current state and dynamics of change in the energy sector. On this basis, the thesis was put forward that the production, generation and use of biomass can become an important element of improving energy policy both in the country and in the EU. Methodologically: an analysis and synthesis was applied for the theoretical background, normative material and new practices on the subject of challenges and

threats to energy security. Including with the use of biofuels. Data on EU intentions and projects were obtained from official international sources. This allowed further operations of abstraction, comparison and generalization. The final conclusion was a summary of own research. In this part, the officially established position of Poland on the directions of energy changes without slowing down the country's economy was used.

4 Results

At the core of its functioning, the Polish energy sector is largely based on hard coal and lignite (Poland, 2022). On one hand, this results in relatively stable electricity production. On the other hand, it means high levels of greenhouse gas emissions, including carbon dioxide, methane, nitrous oxide, fluorocarbons, perfluorocarbons and sulphur hexafluoride, into the atmosphere (Pioch, 2013).

In view of the EU requirements, since 2008, the country has been fulfilling the obligations of the "climate and energy package" (Strateg, 2023). Under this legislative basis, the signatories were obliged to carry out a thorough reform of the energy law, adopt the so-called emission obligations, and increase the share of energy from renewable sources in the entire production balance (Directive, 2003/87).

Failure to meet the requirements of the package may result in shutting down domestic power plants or extremely high financial penalties. The task of the Polish government should therefore be to strive for the intensification of scientific and research works and to create facilities for the development of unconventional energy sources, including solar, wind, hydro, geothermal, and biomass energy. Their use can bring measurable benefits in the field of environmental protection and reduce energy costs (Strateg, 2023). A separate problem in Poland is the poor technical condition of power plants. According to the preliminary assessment of specialists, more than 60% of domestic production capacity is technologically obsolete, decapitalized and ineffective. In addition, the lack of real capacity reserves in the "National Power System" poses a threat to the security and stability of energy supplies. Another major challenge is the necessity of constant transposition of the EU energy law into the Polish legal order (Sokołowski, 2002). This process is complicated not by problems with timely fulfilment of the implementation obligation or lack of social acceptance

for the harmonization of the law, but also due to the shortage of financial and human resources.

An equally important threat is the small territorial range and the high degree of wear of the transmission and distribution networks. The former is used to transfer electricity from the power plant to the grid, while the latter to supply it to consumers. The vast majority of them were built in Poland in the 1970s, and the constant passage of time reduces their technical condition. Their expansion and modernization are necessary, because due to the prevalence of weather anomalies, it is becoming more and more difficult to guarantee supply continuity.

A similar situation applies to natural gas and crude oil distribution networks, whose technical condition remains at the level of technology used at the turn of the 1960s and 1970s and requires urgent modernization. This results in a multitude of complications during the necessary renovations, maintenance, or construction of new infrastructure such as the need to pay high compensation benefits, obtain administrative decisions or carry out works based on much more capital-intensive technologies. An additional threat to the energy security of both individual citizens and the entire country appears in the absence of the owner's consent to enter the property during activities aimed at minimizing or eliminating emergency states. All this, also despite pressure from the EU, has not changed for years (Bartnik, 2014).

The most basic classification of biocomponents divides them into alcohols and esters. Among alcohols, ethanol deserves special mention. Others, such as methanol and butanol, are rarely used. Ethanol is an alternative fuel for low-pressure (gasoline) engines and can be used as a pure fuel (E100 = bioethanol) or as an additive to traditional unleaded gasoline in various proportions. Ethyl and methyl esters can be used as a substitute (B100 = biodiesel) or as an additive to diesel fuel, also in various proportions. Since biodiesel is an alternative fuel to diesel, that is, a diesel fuel, its production and consumption in Poland is by far the largest of all biofuels, due to the popularity of diesel vehicles (KN ORLEN, 2023).

Esters are used in public transportation, freight transport and agriculture. They take the form of an additive as well as a stand-alone fuel. In several Western European countries (Austria, France, Germany) and in Scandinavian countries, esters have

been a well-accepted solution for years. In Poland, the development of this fuel source became more pronounced only in early 2008 (Borychowski, 2012).

Meanwhile, the biofuels sector is occupying an increasingly important place in the energy policy of the European Union and individual member states. This is influenced by a number of factors, the most important of which are the availability and prices of raw materials for the production of biocomponents, crude oil prices and policies to support the supply and demand side. The importance of the biocomponent sector is emphasized primarily for ecological (environmental protection), economic (increases and strong fluctuations in oil prices), social (creation of additional demand for agricultural raw materials, which positively affects the development of agriculture and rural areas) and energy security reasons (Sobierajska, 2009).

Absolutely, therefore, the production and use of biofuels is the branch of the economy that should develop rapidly. The general benefits of their use include: their natural origin and renewable nature; the possibility of reducing oil imports and increasing energy independence; independence from oil price fluctuations and uncertainty about oil availability; activation of the countryside and rural areas through increased demand for agricultural products, and thus additional income for farmers; creation of new jobs at all stages of production and sale of biofuels and biocomponents; possibility to use surplus agricultural raw materials; reduction of emissions of carbon dioxide, aromatic hydrocarbons, nitrogen and sulfur oxides, phosphorus compounds, soot and solids (copper, iron) (Blażejewska, 2011).

On the other hand, domestic opponents of the use of biofuels emphasize their disadvantages: an increase in biofuel production forces the allocation of new land (including valuable and biodiverse land) for biomass production; monoculture of crops for energy purposes can lead to soil depletion and reduced resistance of plants to pests and diseases; a possible increase in the price of food produced from raw materials for energy purposes due to the competitiveness of the directions of raw material use (food production vs. biocomponent production); in the cultivation of raw materials, fuel is used for agrotechnical procedures and energy is used for the production of inputs (e.g. fertilizers); biofuel and biocomponent production processes require significant energy inputs, in addition to generating pollution (e.g. during fermentation of raw materials containing sugars); rising prices of agricultural

raw materials increase the cost of production of biocomponents and reduce its profitability; there are no complete quality standards for biofuels and biocomponents; biofuels have a lower calorific value and their consumption in the combustion process is higher; it is possible that vehicle mechanics problems may occur when burning esters, which increases vehicle maintenance costs (Biernat, 2010; Błażejewska, 2011; Borychowski 2011; Lach, 2013; Pioch 2013; KN ORLEN, 2023).

5 Discussion and Conclusion

The problem of anticipated changes in the area of energy security due to the wartime events in Ukraine has been brought to a very high level of theoretical and practical research. The EU's position here is clear - the negative impact of the energy sector must be short-lived, small and quickly minimized. The "Green Deal" industrial plan will help with this (Wold Economic Forum, 2023).

In Poland, the biofuels sector is developing and growing in size. However, this progress is uneven, as the biodiesel sector is at a much higher stage of development. This state of affairs needs to change. EU requirements are gradually increasing, so Poland should create a robust and absorbent market as soon as possible for the benefit of both producers and consumers of bio-components.

There is a practical implication: given the assumed costs of the energy transition and the requirements of the "Green Deal" in Poland, preparatory measures must be taken, and this includes the use of biomass resources.

However, each member country, including Poland, manages energy in its own way. This is due to various conditions (owned deposits, industrial production, long-term supply contracts and others). Therefore, Poland does not want to make revolutionary and financially demanding changes in energy security at the expense of slowing down its economy. In the long term, however, it is estimated that these measures will be necessary.

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