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ORIGINAL PAPER

# PERSPECTIVES FOR ENERGY DEVELOPMENT IN POLAND AND IN THE EUROPEAN UNION IN THE CONTEXT OF THE EUROPEAN GREEN DEAL: RENEWABLE ENERGY AND ENERGY EFFICIENCY

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K e y w o r d s: European Green Deal, energy transition.

A b s t r a c t

The European Green Deal is a development strategy which aims to transform the European Union into a climate-neutral area by 2050. Due to the scale of reforms it envisages, it is considered the largest legislative initiative in the history of the European Union. The research aims to analyse the prospects for energy development in Poland and in the European Union in the context of the European Green Deal, with a particular focus on potential ways to increase the share of renewable energy sources and improve energy efficiency.

Given the highly disparate environmental and socio-economic conditions, a number of EU countries will find it challenging to meet the ambitious requirements of the European Green Deal. Additionally, considering the huge impact of the Coronavirus pandemic and the war between Russia and Ukraine, the use of a sustainable energy security concept seems justified, as it takes into account the socio-technical specificities of individual states. A predictable energy and climate policy consistent with the EU's objectives may facilitate Poland's fair transition towards sustainable development.

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# PERSPEKTYWY ROZWOJU ENERGETYKI W POLSCE I W UNII EUROPEJSKIEJ W KONTEKŚCIE EUROPEJSKIEGO ZIELONEGO ŁADU – ENERGIA ODNAWIALNA I EFEKTYWNOŚĆ ENERGETYCZNA

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Słowa kluczowe: Europejski Zielony Ład, transformacja energetyczna.

Abstrakt

Europejski Zielony Ład jest strategią rozwoju, która ma przekształcić Unię Europejską w obszar neutralny klimatycznie do 2050 roku. Z uwagi na skalę zakładanych w nim reform jest uznawany za największą inicjatywę legislacyjną w historii Unii Europejskiej. Celem badań jest analiza perspektyw rozwoju energetyki w Polsce i w Unii Europejskiej w kontekście Europejskiego Zielonego Ładu, ze szczególnym uwzględnieniem potencjalnych sposobów zwiększenia udziału odnawialnych źródeł energii i poprawy efektywności energetycznej.

Z uwagi na bardzo zróżnicowane uwarunkowania środowiskowe i społeczno-ekonomiczne wiele krajów UE będzie miało duże problemy ze spełnieniem ambitnych założeń Europejskiego Zielonego Ładu. Uwzględniając dodatkowo ogromne skutki pandemii COVID-19 oraz wojny rosyjsko-ukraińskiej, uzasadnione wydaje się wykorzystanie koncepcji zrównoważonego bezpieczeństwa energetycznego, uwzgledniającej społeczno-techniczne uwarunkowania poszczególnych krajów. Przewidywalna i zgodna z unijnymi celami polityka energetyczno-klimatyczna może ułatwić Polsce przeprowadzenie sprawiedl COVID-19 iwej transformacji w kierunku zrównoważonego rozwoju.

## Introduction

The concept of sustainable development has been incorporated into the strategy of the European Union through the Treaty of Amsterdam. In order to implement its principles in practice, it requires, first and foremost, the efficient use of energy resources (Vasylieva *et al.*, 2019; Semenenko *et al.*, 2019; Bilan *et al.*, 2019). Since having access to these resources has a fundamental impact on the processes taking place in the socio-economic space, they are a hotbed of regional conflicts (see Belyi, 2015). Such circumstances have forced the international community to adopt a new path of global development through sustainable energy. Like the term "sustainable development", this concept is based on three pillars: stable economic development, environmental protection and meeting social needs (see Balcerzak & Pietrzak, 2017; Wierzbicka, 2022).

The European Green Deal, with the main objective of achieving EU climate neutrality in 2050, has become an extremely ambitious development within the concept of sustainable energy. It was announced by the European Commission in 2019, just a few months before the outbreak of the COVID-19 pandemic.

The pandemic triggered a significant socio-economic crisis across the European Union, despite engaging large amounts of financial support from national budgets. In order to provide additional support to Member States affected by the COVID-19 pandemic, the European Commission has launched a temporary EU Recovery plan (Next Generation EU) (European Commission, 2019). The largest part of the Recovery Fund is the Recovery and Resilience Facility (RRF). Parts of the RRF programme changed as a result of Russia's invasion of Ukraine in 2022. To reduce the EU's dependence on Russian fossil fuels, the European Commission decided to accelerate the spread of renewable energy, diversify supply and reduce energy demand (see REPowerEU, 2022). The EGD (European Green Deal), which is currently taking shape as part of the 'Fit for 55' package, envisages, among other things, a reduction in greenhouse gases of at least 55% in 2030 compared to 1990 (REPowerEU, 2022).

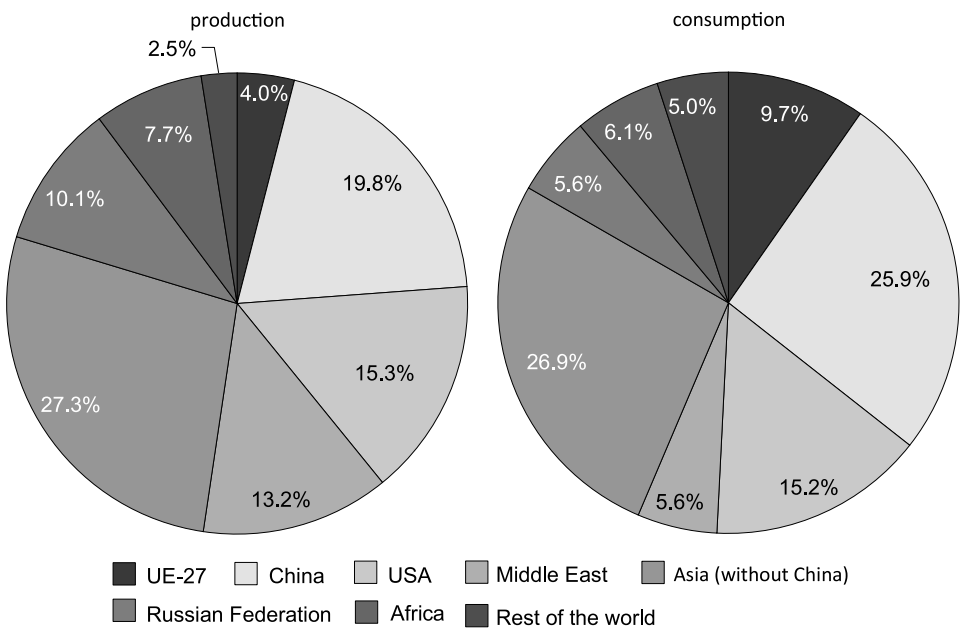


Fig. 1. Global structure of energy production and consumption worldwide (2020)
Source: own compilation based on: *EU energy in figures. Statistical Pocketbook* (2022).

One of the most challenging issues surrounding Europe's energy transition is the EU's very high dependence on imports of energy carriers. In 2020, 97% of the EU's demand for crude oil and petroleum products was satisfied by imports, and likewise, 83.6% of natural gas was also imported. At the EU level, 35.8% of solid fossil fuels were imported in 2020. The long-term trend observed since 1990 has shown an increasing dependence of the EU on imports of energy carriers. While 57.5% of all fuels consumed were imported in 2020, the share stood

at 50% in 1990. The EU's significant energy dependence is also evidenced in the comparison of the EU's contribution (4.0%) to global primary energy production with the EU's share of energy consumption (9.7%) (Fig. 1). This dependence upon external energy resources largely explains the EU's commitment to the practical implementation of the EGD targets. This is manifested mainly in an effort to increase the energy efficiency of the macro-sectors of EU economies and to increase the use of renewable energy sources.

Since 2007, the European Union has approved a climate and energy package (the so-called 3×20) requiring Member States to achieve specified quantitative targets, including greenhouse gas emissions and energy production from renewable sources (RES) (see Kasperowicz *et al*., 2017).

In 2014, the EU continued its direction on climate change and set four targets in the 2030 perspective, which after revisions in 2018 and 2020, are as follows:

– a reduction in greenhouse gas (GHG) emissions of at least 55% compared to 1990 emissions;

– at least 32% share of renewable sources in gross final energy consumption;

– an increase in energy efficiency of 32.5%;

– completion of the EU internal energy market.

Against this background, the objective of the study is to analyse the perspectives for energy development in Poland and in the European Union in the context of the European Green Deal, with particular reference to the possibility of increasing the share of renewable energy sources and improving energy efficiency.

The remainder of this paper is an attempt to diagnose the current state and prospects for the development of the energy sector in Poland and the EU in the context of the objectives of the European Green Deal.

## Overview of the Energy Situation in the European Union

Between 2000 and 2020, final energy consumption increased globally by 36% to reach 9,573 Mtoe. The largest increase in final energy consumption in the corresponding period was seen in China (177%), while energy use in the EU decreased by 6.2%. Poland was one of the few EU countries where final energy consumption has increased since the beginning of the century (by 31%). This increase in energy demand in Poland was a natural consequence of economic growth. At the same time, it is worth noting that the value of Poland's energy efficiency indicator[1] increased by more than 71% in 2020 compared to 2000, while the EU average productivity increased by 37%. Still, Poland's energy efficiency represents only 55% of the EU average.

[1] The final efficiency indicator was calculated as the ratio of the volume of annual GDP to the amount of final energy consumed.

Disparities are also observable in the structure of gross energy consumption in Poland in relation to that in the entire EU27 (Figs. 2 and 3). Between 1995 and 2020, the dominant energy carrier in gross energy consumption in Poland was solid fossil fuels, with a share of 40.1% in domestic consumption in 2020. From the point of view of the objectives of the European Green Deal, a positive trend is the increasing use of energy from RES, which accounted for 12.7% of gross energy consumption in 2020 (Fig. 3). By comparison, the share of renewables in EU gross energy consumption was 17.5%, while solid fossil fuels were only 10.2%.

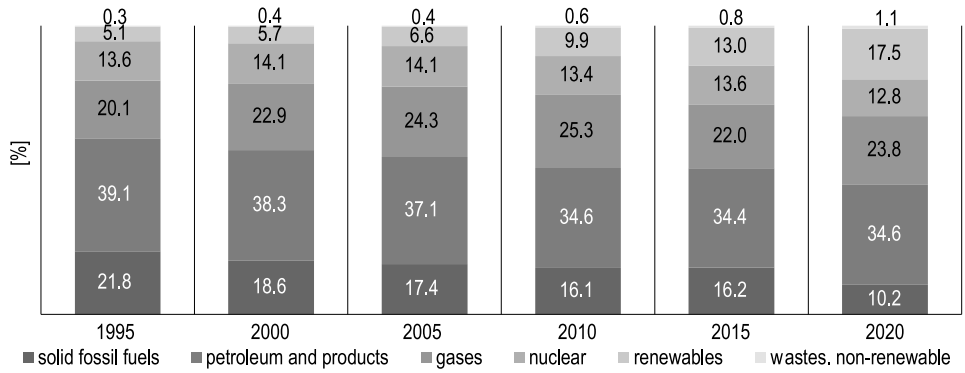


Fig. 2. Share of individual energy carriers in gross energy consumption in the EU 27
Source: own compilation based on Eurostat data.

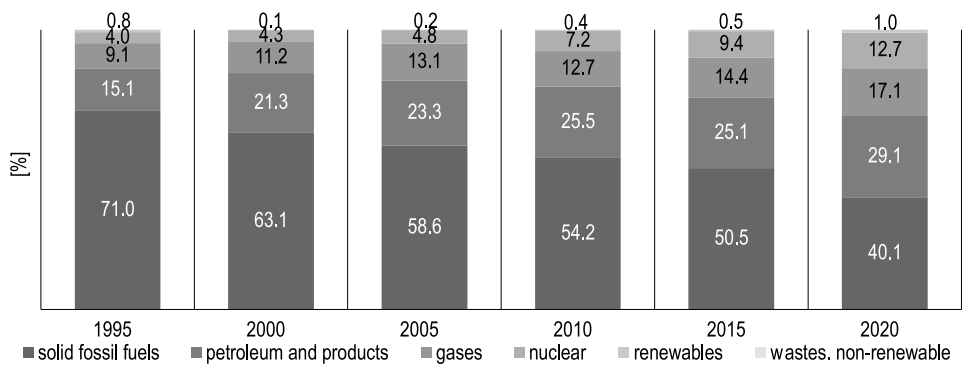


Fig. 3. Share of individual energy carriers in gross energy consumption in Poland
Source: own compilation based on Eurostat data.

Juxtaposing the share of selected countries in the consumption of a given energy carrier in the EU27 with the share of that particular state in total gross energy consumption of the EU27 makes it possible to assess the degree of dependence of a national economy on a given energy source. A graphic depiction of these dependencies is provided in Figure 4, where the selected EU member

states are shown in the form of a hexagon. The vertices symbolise the energy carriers, while the distance from the central point reflects their significance for the domestic energy systems. Analysis of the consumption profile of energy carriers in Poland indicates a gradually diminishing role of solid fossil fuels as an energy source. By contrast, the position of crude oil, natural gas and RES in the consumption structure of the major energy sources has increased over the past two decades. Among the reviewed states, Germany is characterised by the most multidirectional consumption profile of the key energy carrier groups. In France, on the other hand, nuclear energy is the main source of energy, accounting for 75% of the energy consumed in the state (Fig. 4).

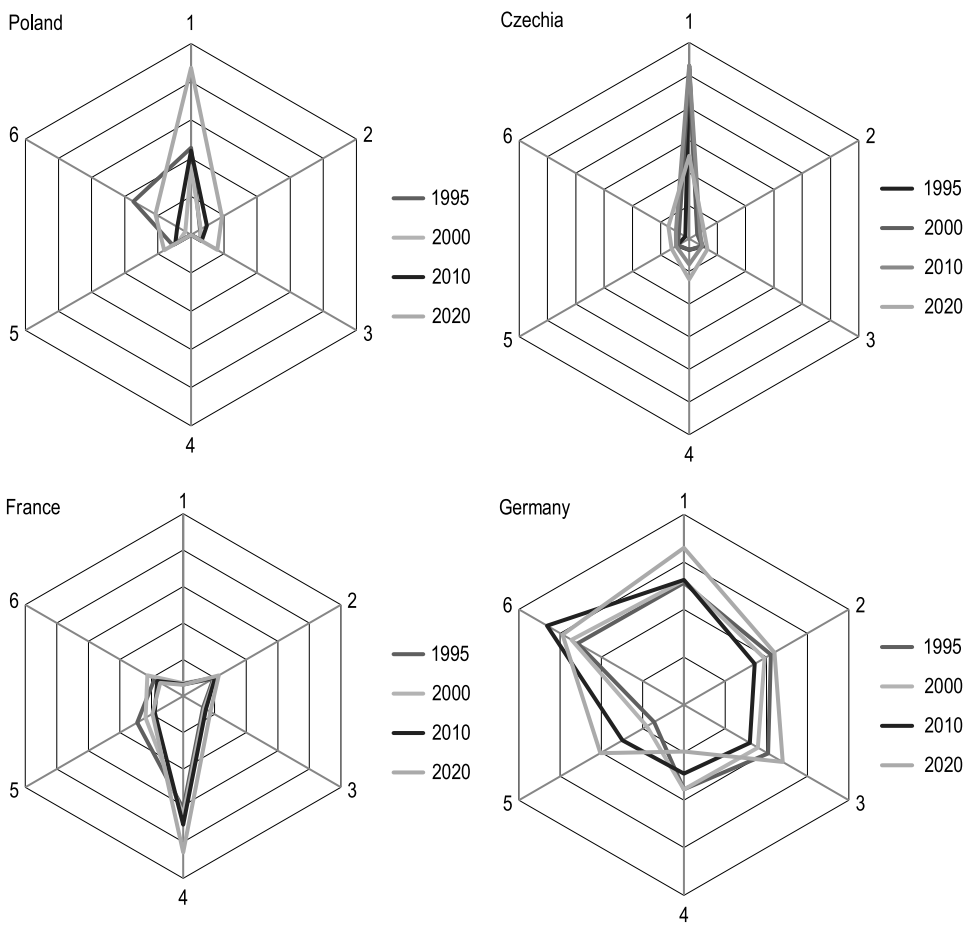


Fig. 4. Graphical overview of the consumption profiles of energy carriers in selected EU states, 1995-2020

Source: own compilation based on Eurostat data.

There were several developments in final energy consumption across macro-sectors in the EU over the analysed period. The industrial sector reduced its final energy demand in 2020 by 30.3% compared to 2000. A decrease in energy consumption was also observed in the household sector (by 21.8%) and in transport (by 27.1%). In 2020, transport accounted for the largest share of final energy consumption in the EU27 (29.6%), closely followed by private consumers (29.1%) and industry (27.1%) (Fig. 5). When analysing the data for 2020, it is essential to consider the COVID-19 pandemic, which significantly affected the volume and structure of energy consumption in the EU. The overall trends over the entire period under review reflect primarily structural changes in the EU economy, i.e. a departure from an energy-intensive economy and an ever-increasing share of services.

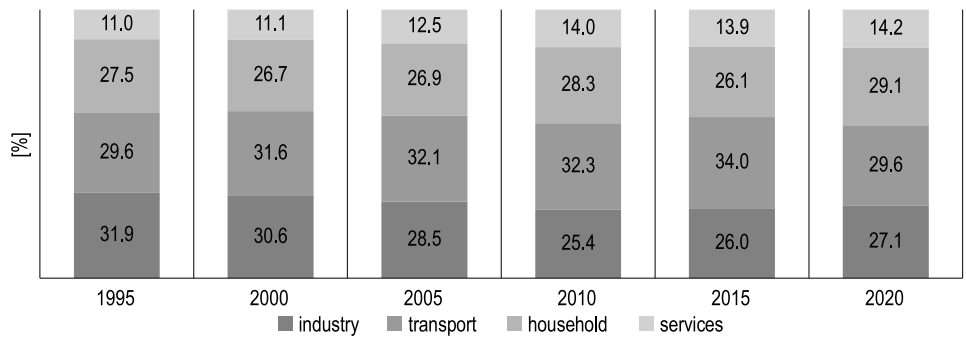


Fig. 5. Structure of final energy consumption by sector in the EU27
Source: own compilation based on Eurostat data.

Unlike in the EU, there have been fundamental changes in energy consumption in individual macro-sectors in Poland. First of all, it is necessary to emphasise the more than twofold increase in final energy consumption in the transport sector (by 119.5%), which accounted for 32.9% of total final energy consumption in Poland in 2020. As with the EU average, energy demand in Poland also

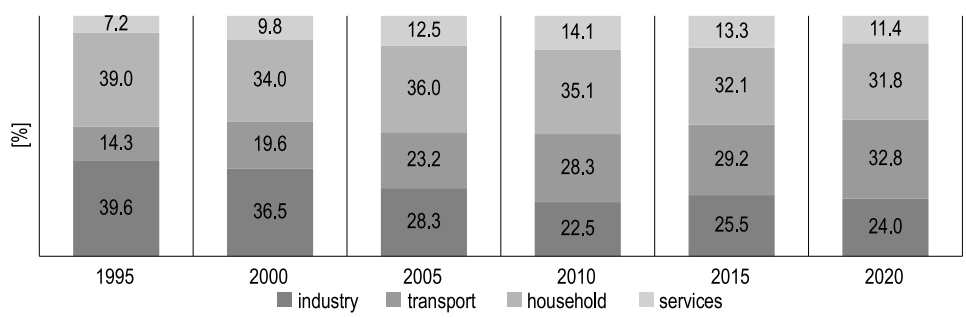


Fig. 6. Structure of final energy consumption by sector in Poland
Source: own compilation based on Eurostat data.

increased in the services sector (by 23.6%) and decreased in industry by 30.7%. Polish households are one of the largest energy consumers, and this sector has the greatest potential for reducing energy consumption (Fig. 6).

## Energy Efficiency in EU Countries

The issue of energy efficiency is treated in the EU as one of the three strategic objectives of the European Green Deal. The energy intensity of a national economy can be measured by the ratio of both primary and final energy consumption to the corresponding volume of production (measured by the level of GDP) (see Kasman & Duman, 2015).

Currently, the energy intensity of the Polish economy is estimated to be almost twice as high as the European average (Fig. 7). However, it should be stressed that over the last two decades, the energy intensity of Poland's final GDP has almost doubled. In 2000 it was 363 kgoe/1,000 euro, while in 2020 it was 212 kgoe/1,000 euro. Positive trends in energy efficiency in Poland are also confirmed by changes in the value of final efficiency indicators between 2000 and 2020. The gross energy efficiency of Poland's GDP, expressed in constant 2010 prices, stood at 4.7 euro/kgoe in 2020 and was 71% higher than in 2000 (2.7 euro/kgoe). If purchasing power parity is taken into consideration, Poland's energy efficiency increased by 122% over the analysed period, and the rate of improvement in this efficiency was higher in Poland than in the European Union (Fig. 8).

## Proportion of Energy from Renewable Sources

The Directive of the European Parliament and of the Council on the promotion of the use of energy from renewable sources (2009/28/EC) has been in force in the EU for more than 15 years. By 2020, 20% of final energy consumed across the EU was supposed to come from renewable sources, with different target percentages assigned to individual Member States. These targets were set at such a level that, on the one hand, they were realistic to achieve and, on the other hand, incentivised individual states to increase their RES share (see Scarlat *et al*., 2015).

Overall, the EU27 had a 22% RES share in final energy consumption in 2020, and of the 27 countries, 23 exceeded their targets. Only France failed to meet its target of 23% RES share of final energy consumed (Fig. 9).

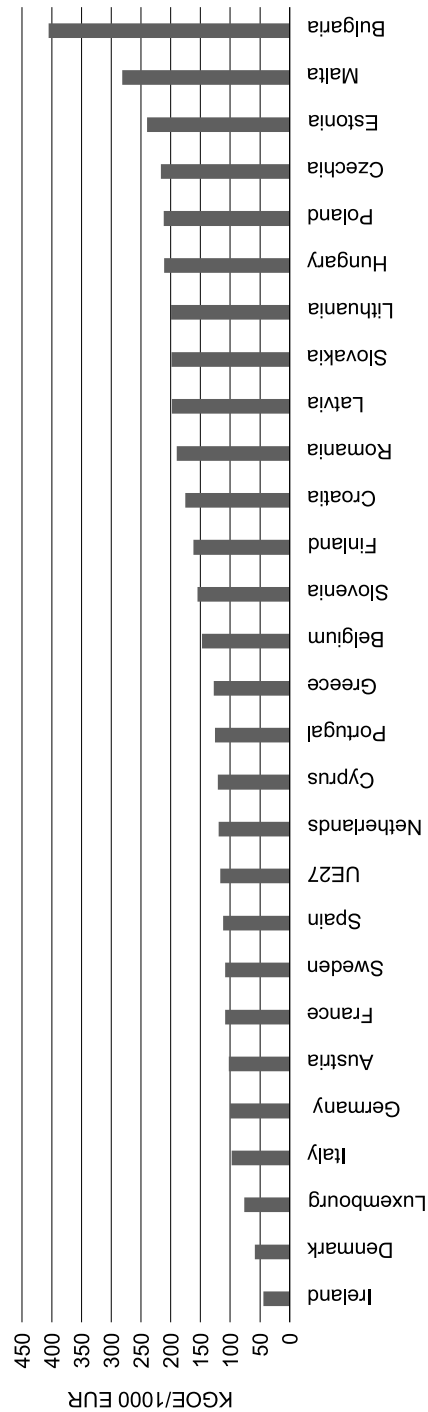


Fig. 7. Final energy intensity of GDP of EU economies in 2020 (energy intensity of the economy – expressed as a ratio of energy consumption to GDP, at market prices)

Source: own compilation based on Eurostat data.

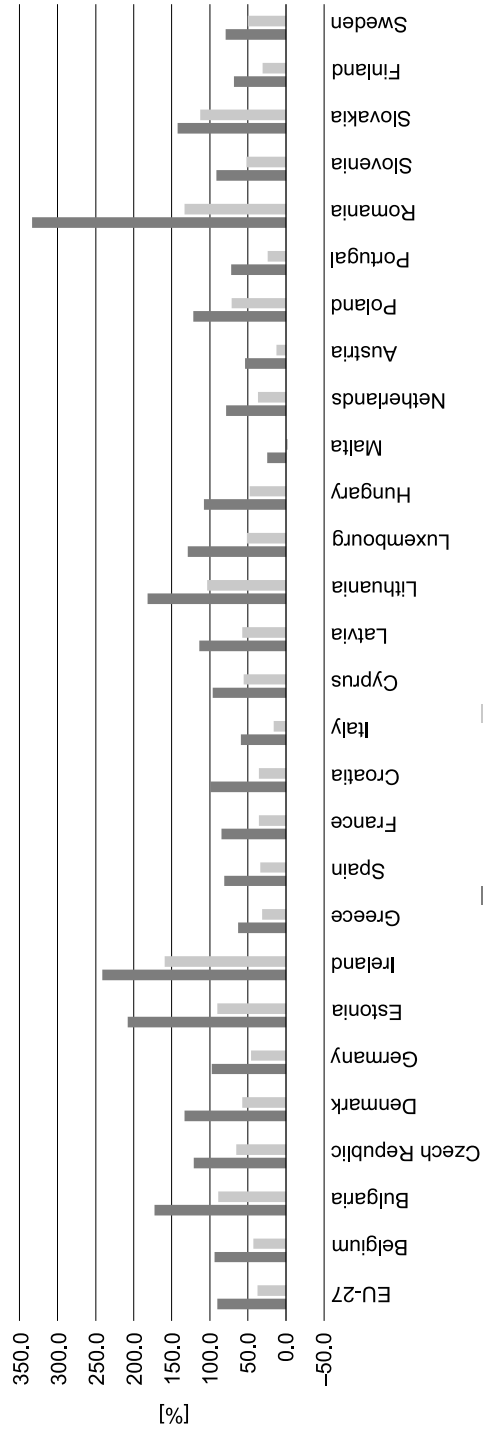


Fig. 8. Evolution of energy efficiency in EU countries 2000-2020

Source: own compilation based on Eurostat data.

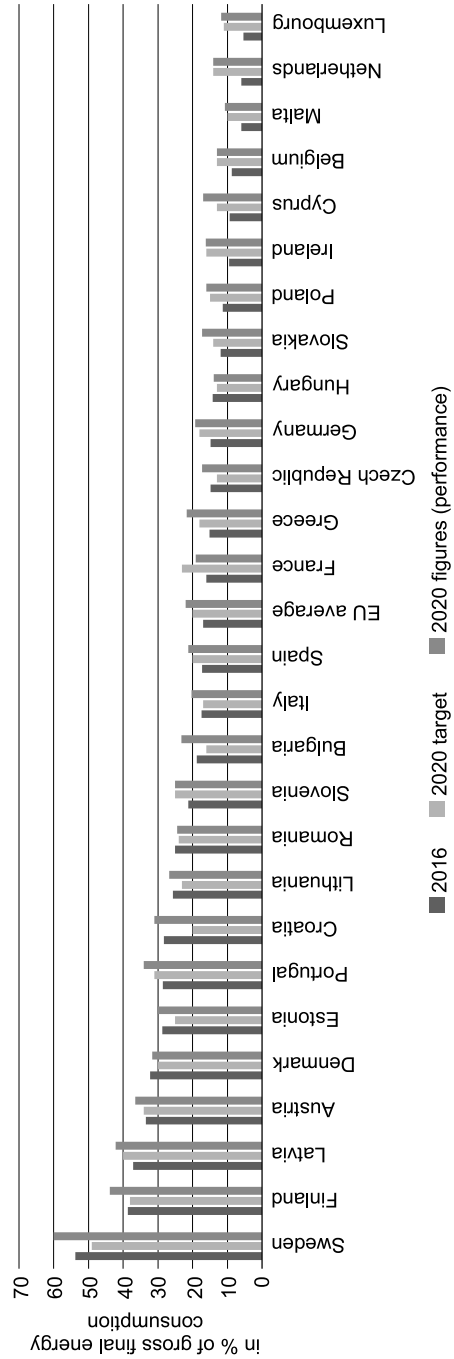


Fig. 9. Share of RES in EU27 in 2020

Source: own compilation based on Eurostat data.

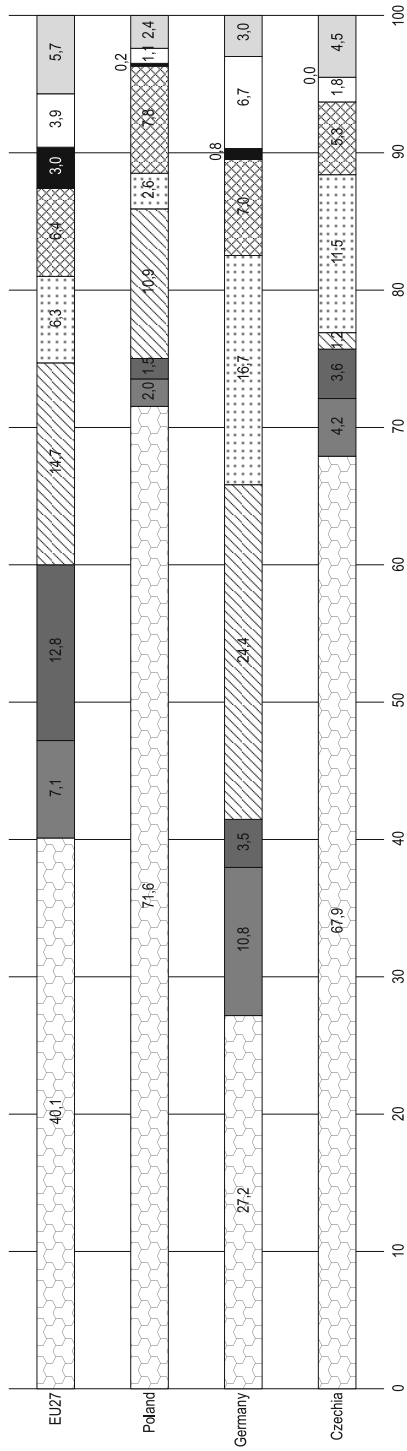


Fig. 10. Structure of energy generation from renewable sources (by carrier) for Poland, the EU27 and selected Member States

Source: own compilation based on Eurostat data.

The structure of renewable energy generation (by source) in the EU27 and Poland in 2020 is shown in Figure 10. The structure of renewable energy generation for Poland differs fundamentally from the structure of RES sources for the EU27. Similar to other states (Czechia), this structure stems primarily from the geographical conditions specific to Poland and the resources that can be utilised.

Solid biofuels dominated the production of energy from renewable sources in Poland, accounting for up to 71.6% of energy production from RES in 2020. In the period under review (2005-2020), the share of wind energy increased from 0.3% to 10.9%, solar energy went from almost zero to 2% and liquid biofuels (bioethanol plus biodiesel) from 2.6% to 7.8%. In absolute terms, the largest increase in the use of renewable energy was seen in the case of wind energy. By 2020, more than 7,300 wind turbines with a total capacity of nearly 7,400 MW had been installed in Poland, representing approximately 17% of the country's installed energy capacity. Comparing the structure of RES energy consumption for Poland and selected EU countries (Germany, Czech Republic) helps to view the shortcomings of adapting the structure of RES production and consumption in Poland to the natural and economic conditions of the country, which should also be associated with the weaknesses of state policy in supporting the development of renewable energy (see also Szyja, 2016). In Western states (Germany), biogas production is being intensively developed, which proves to be more efficient in many EU countries than other RES carriers, e.g. wind or solar energy (see Scarlat, 2018).

The extent of renewable energy use in individual sectors is also of key significance. Figure 11 shows the share of RES in three sectors for the period 2005-2020.

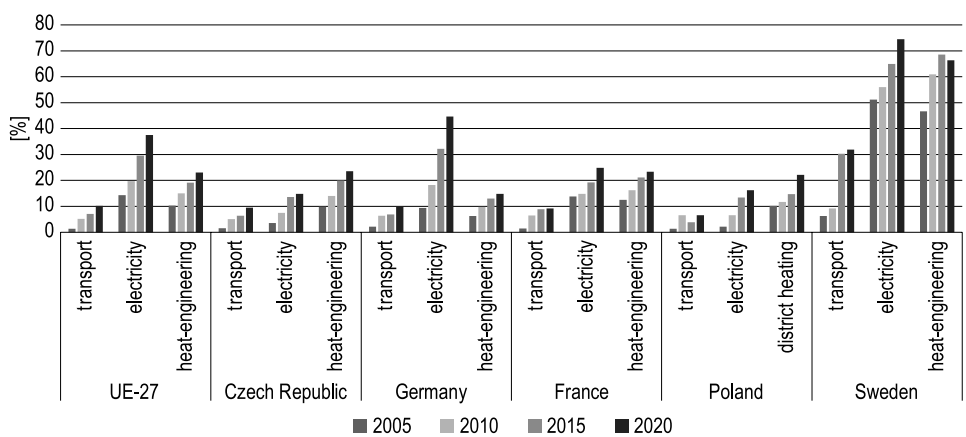


Fig. 11. Share of RES in gross final energy consumption by sector in selected EU states
Source: own compilation based on Eurostat data.

During the period under review, the share of RES was increasing in all sectors considered, but the largest share was found in district heating. In 2020 in Sweden, for example, 66% of thermal energy came from renewable sources, with as much as 75% of electricity coming from this source. Similarly, renewable energy in Poland is used primarily in electricity generation and district heating. Renewables are used to a relatively smallest extent in transport, which is dominated by traditional energy carriers. For this reason and given the projected increase in this sector's contribution to national GDP, increasing the use of RES to power transport modes is going to be one of the greatest challenges for the EU's Green Deal.

## Summary and Conclusions

The European Green Deal is an ambitious European Union action plan designed to accelerate Europe's transition towards a sustainable, green and fair society. As part of the European Green Deal, the EU intends to invest in renewable energy sources and promote energy efficiency, which can contribute to greater energy independence and improved stability of energy supply in the future. Meanwhile, the war in Ukraine and the COVID-19 pandemic have served as a reminder of the pressing need to ensure the stability and security of the EU's energy supply in the years to come. In order to minimise the risk of energy supply shortages, the EU is taking a number of measures, such as diversifying energy sources, developing energy infrastructure, increasing energy efficiency and improving internal coordination in the energy market. Regardless of these efforts, the cost of energy in the EU is steadily rising, which could ultimately have a negative impact on social and economic development. Such a situation would be contrary to the principles of sustainable development. Furthermore, some states, including Poland, may face particular problems in coping with the EU's energy policy. Some EU countries enjoy favourable environmental conditions in terms of sustainable development policy, e.g. Sweden and Denmark, and may shape their energy system exclusively on the basis of renewable sources. Being a country largely driven by a coal-based economy, Poland still has major challenges to overcome when transforming its energy mix, particularly in the development of renewable energy sources, which needs to be complemented by other technologies, including gas and nuclear power. The opening of the Baltic Pipe pipeline in 2022 can help to replace coal as an energy source, which is crucial for Poland to meet its climate goals in a 5-10 year timeframe. In the longer term, Poland plans to use nuclear energy as a buffer for the energy system, as nuclear power plants are capable of continuous operation. Poland shows great potential for the development of renewable energy, particularly wind and solar energy. Wind and solar energy are dependent on weather conditions and are inconsistent in power generation. In such situations, nuclear power plants can

act as a buffer and supply energy to the grid in the event of a shortage of energy from other sources.

As part of the European Green Deal, the EU focuses on the development of renewable energy sources and energy efficiency. As non-renewable energy sources, nuclear power and natural gas do not fit into this concept.

Against this background, hydrogen appears to be one of the most promising energy carriers that have the potential to play an important role in the energy transition. Hydrogen can be produced from a variety of energy sources, including wind and solar energy, as well as biomass or water through electrolysis processes. Hydrogen can also act as an energy buffer, allowing electricity to be stored during times when there is an excess of energy, such as when there is an overproduction of wind or solar energy, and then used during periods when energy production is lower.

That being said, the introduction of hydrogen into the energy system requires significant investment in production, distribution and storage, as well as the development of technologies, such as fuel cells, that will enable the use of this energy carrier in various sectors, such as transport. Despite these challenges, hydrogen can contribute to developing new technologies, improving energy security and increasing the competitiveness of the EU economy. To this end, in 2020, the European Commission announced a programme called the European Hydrogen Strategy, which intends to promote the production and use of hydrogen as an energy carrier, as well as the development of hydrogen-related technologies (European Commission, 2020).

## References

Balcerzak, A.P., & Pietrzak, M.B. (2017). Sustainable Development in the European Union in the years 2004-2013. In M.H. Bilgin, H. Danis, E. Demir, & U. Can (Eds.). *Regional Studies on Economic Growth, Financial Economics and Management. Proceedings of the 19th Eurasia Business and Economics Society*. Vol. 7, Springer International Publishing, 193-213. https://doi.org/10.1007/978-3-319-54112-9_12.

Belyi, A.V. (2015). Energy in international political economy. In *Transnational gas markets and Euro-Russian energy relations*. London: Palgrave Macmillan.

Bilan, Y., Streimikiene, D., Vasylieva, T., Lyulyov, O., Pimonenko, T., & Pavlyk, A. (2019). Linking between Renewable Energy, $CO_2$ Emissions, and Economic Growth: Challenges for Candidates and Potential Candidates for the EU Membership. *Sustainability*, *11*(6), 1528.

European Commission. (2019). *The European Green Deal*. COM/2019/640. Retrieved from (18.11.2022).

European Commission. (2020). *A hydrogen strategy for a climate-neutral Europe*. COM/2020/301. Retrieved from https://eur-lex.europa.eu/legal-content/PL/TXT/PDF/?uri=CELEX:52020DC0301&from=IT (15.11.2022).

Kasman, A., & Duman, Y.S. (2015). $CO_2$ emissions, economic growth, energy consumption, trade and urbanization in new EU member and candidate countries: a panel data analysis. *Economic Modelling*, *44*. https://doi.org/10.1016/j.econmod.2014.10.022.

Kasperowicz, R., Pinczyński, M., & Khabdullin, A. (2017). Modeling the power of renewable energy sources in the context of classical electricity system transformation. *Journal of International Studies*, *10*(3), 264-272. https://doi.org/10.14254/2071- 8330.2017/10-3/19.

Pietrzak, M.B., Balcerzak, A.P., Gajdos, A., & Arendt, Ł. (2017). Entrepreneurial environment at regional level: the case of Polish path towards sustainable socio-economic development. *Entrepreneurship and Sustainability Issues, 5*(2), 190-203. https://doi.org/10.9770/jesi.2017.5.2(2).

*REPowerEU: a plan to rapidly reduce dependence on Russian fossil fuels and fast forward the green transition*. (2022). Retrieved from https://ec.europa.eu/commission/presscorner/detail/en/IP_22_3131 (15.11.2022).

Semenenko, I., Halhash, R., & Sieriebriak, K. (2019). Sustainable development of regions in Ukraine: before and after the beginning of the conflict. *Equilibrium. Quarterly Journal of Economics and Economic Policy*, *14*(2), 317-339. https://doi.org/10.24136/eq.2019.015.

Scarlat, N., Dallemand, J.F., & Fahl, F. (2018). Biogas: Developments and perspectives in Europe. *Renewable Energy*, *129*, Part A. https://doi.org/10.1016/j.renene.2018.03.006.

Vasylieva, T., Lyulyov, O., Bilan, Y., & Streimikiene, D. (2019). Sustainable economic development and greenhouse gas emissions: The dynamic impact of renewable energy consumption, GDP, and corruption. *Energies*, *12*(17), 3289.

Wierzbicka, W. (2022). Activities Undertaken in the Member Cities of the Polish National Cittaslow Network in the Area of "Energy and Environmental Policy". *Energies*, *15*, 1309. https://doi.org/10.3390/en15041309.