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Transformation of the energy sector and its impact on the European Union's external trade in energy raw materials in 2000–2020

INTRODUCTION

An analysis of the development and structural changes in the energy sector, as well as energy raw materials markets, makes it possible to distinguish five energy transformations. The first included the change of the economy from one based on wood and coal to the production and distribution of electricity. Nevertheless, the primary source of energy was still coal. Consequently, at the beginning of the 1890s, the power of the economy (developmental potential) was based on the excavation of coal (Hugill, 1995, p. 31). The second transformation began at the turn of the 20th century as a result of the increasing extraction of oil which was replacing coal and caused revolutionary changes in transportation (development of motorisation and aviation).

The third energy transformation began in the 1950s and was characterised by a large decrease in the role of coal which was being replaced by oil and diversification of energy sources. There was an increase in the share of water and nuclear power plants in the total production of electricity. However, despite the diversification of energy sources, oil became the strategic material. It contributed to the growth of the economic and geostrategic position of oil-rich countries, mainly

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the Arabic ones. What deserves particular emphasis is the impact on the increase in the role of the energy sector in consumer demand for fuels and electricity since consumption patterns changed in highly developed countries (development of private motorisation, equipping households with electromechanical devices and development of business transportation). For the first time, consumption demand grew in significance as a source of economic growth. Low oil prices were conducive to high economic growth dynamism until the early 1970s. During the late 1960s, the price of crude oil was around 3 USD per barrel (Newton, 2004, p. 107).

Long-term economic consequences stemmed from the fourth energy transformation in the 1970s, which was a consequence of the energy and economic crisis, resulting in increases in the prices of oil and other natural resources. Rising inflation and switching to floating exchange rates contributed to increased currency risk (Mucha-Leszko, Kąkol, 2012, p. 315). Recession in industrial economies, inflation, currency destabilisation, growing unemployment, and the lack of a lasting recovery all obliged companies to work on energy-saving technologies and alternative sources of energy. In 1974, more than 70% of investment in research was directed to nuclear power (Kuzemko, Lawrence, Watson, 2019, p. 5). The 1970s revealed the impact that the oil market has on the world economic situation, which was unable to regain the capacity for economic growth for a dozen years. The situation also constituted a warning on how dangerous the dependence on a dominant energy resource and price policy of oil monopolies was (Rynarzewski, 1982). Economic stabilisation did not return until the mid-1980s.

The truly revolutionary fifth transformation of the energy sector started in the last decade of the 20th century. It was caused by a number of factors, with the major ones being: 1) technological progress allowing access to new deposits of natural gas and oil as well as utilisation of renewable energy resources which leads to greater diversification, 2) fast-paced industrialisation of some developing countries and growing population contributed to a noticeable increase in energy demand, and the highest impact on the upturn in energy consumption originated in China, India, the Republic of Korea and Brazil, 3) rise in demand, production and consumption of energy are not without an impact on the environment and climate due to greenhouse gas emissions. Transformation of the energy sector remains one of the major global issues of contemporary development. It aims at reconciling economic growth with energy security, as well as environmental and climate security. This is related to the need to increase the role of alternative energy sources. Both the supply and demand changes in the energy markets, intensified competition and diversification of the supplier markets constitute a huge challenge for everyone – producers, exporters and importers of oil. The European Union is a leader in the transformation of the energy sector that is leading to the shift to

low-emission energy sources. The EU is also (as a grouping) the largest global importer of energy and one of the top 3 of the world's largest exporters, second behind Russia and followed by the United States (2018).

The transformation of the energy sector and the diversification of the markets affect trade relations and result in certain changes in the geographical structure of exports and imports of energy commodities. Exporters of conventional energy sources, such as Russia, aspire to maintain their shares in the main markets. Russia's energy resources and position in fuel trade remain its main source of economic power, and the EU is the largest destination market for its oil and natural gas. Therefore, the question arises regarding the impact of the transformation of the energy sector on the new balance in the energy market.

The objective of the paper is to evaluate changes in 2000–2019/2020 of: 1) the level of energy consumption and the share of the main energy sources used in consumption in the world, in the EU and the 15 largest consumer countries, 2) energy import structure by sources, and 3) energy export structure by sources. Structural changes in the imports and exports of EU energy resources are treated as a consequence of the energy policy conducted at the group level and in individual member states.

The paper includes the following sections: method, review of the literature, analysis of energy consumption in the EU compared to other major consumers, analysis of the EU's external trade in energy resources, as well as discussion of the results with reference to other researchers, and conclusion.

METHOD

The theoretical analysis of the energy sector transformation is carried out using an interdisciplinary approach based on the methods used by representatives of the International Political Economy. The authors adopt their methods of ontological analysis of reality, meaning phenomena, processes, and results of interdependence in international economic and political relations, as well as their causality. The empirical analysis conducted in the paper uses the following indicators: growth rates of energy consumption, shares of selected countries and the EU in the global energy consumption, shares of major energy sources in the consumption of energy in the selected economies, shares of major energy sources in exports and imports of the EU and its member states, indicators of dependency in the EU and member states on energy imports. The data used in the paper were derived from the databases of the International Energy Agency, OECD, and Eurostat, as well as reports prepared by British Petroleum (BP) and Enerdata. The analysis covered the period 2000–2020 when data availability allowed. In some cases, the latest available statistics were used.

LITERATURE REVIEW – CONCEPTUALISATION OF ENERGY, TRANSFORMATION OF THE ENERGY SECTOR, AND POLICY IN TERMS OF RESEARCH ASSUMPTIONS OF INTERNATIONAL POLITICAL ECONOMY

Dynamic internationalisation and globalisation of economic processes added to the intensification of research and theoretical debate, which, since the 1990s, have been dominated by disputes between neoliberals and neorealists. Many partial theories were developed within the two main paradigms, including transnational approach, security theory, constructivism, postmodernism, critical theory, and others (Zięba, Bieleń, Zając, 2015, p. 8–11). Although the development of the international political economy (IPE) was closely related to the internationalisation of the economic activity of enterprises and the increased investment activity of transnational corporations, initially, the IPE authors focused on researching the political implications of economic interdependence in an analytically arbitrary manner (Keohane, 2009, p. 43).

The origins of energy conceptualisation are associated with the energy crises of the 1970s, and definitions of energy security were formulated then as well. It can be considered from a national point of view but also in a regional and global dimension. In the first instance, the approach to security is a consequence of the resources of energy materials available in the country as well as the degree of dependence on their imports. For economies reliant on imports, energy security means ensuring supplies at reasonable prices, and for countries rich in energy resources, they become sources of high income from exports and means to strengthen their geopolitical position. The contemporary understanding of energy security remains closely connected with global warming resulting from the growing consumption of energy obtained from fossil resources, in particular coal, and this issue can only be solved on a global scale.

Representatives of the current IPE, mainly during the past decade, have conducted a lively discussion justifying the need to transform the energy sector and move towards a low-carbon economy, thus developing the theoretical foundations of the new approach to energy and its economic and political importance.

The multifaceted definition of energy facilitates the conceptualisation of energy policy. Considering the use of energy, the concentration of energy resources in some regions of the world and a few countries, the effects on the environment and taking the issue as a whole, certain matters should be emphasised (Herrenz-Surrallès, 2015, p. 2): 1) its importance from a technological perspective as a factor conditioning the development of production, and from a commercial perspective as a normal commodity; 2) due to the limited access to resources, as a strategic product; and 3) due to the wide application in households, as a service for the population. On the other hand, the negative effects of growing energy

consumption make it a factor of environmental degradation and serious climate changes, which pose a threat to civilization.

A. Herrenz-Surralles, referring to the works of Goldthau, Witt and Lesage, presents a proposal for the conceptualisation of the EU's external energy policy based on three factors that characterise it from an empirical perspective. The factors are (Herrenz-Surralles, 2015, p. 2): 1) common energy regulatory space liberalising the internal energy market and defining clear competition rules for its external participants, 2) diversification of energy sources and the use of rescue projects in crisis situations, 3) inconsistency of the goals of the energy policy from the group's perspective with the goals of the member states, inconsistency with the other goals of the EU's foreign policy, and the need to achieve greater alignment of the goals in the energy policy implemented at the global level (defined in the Paris Agreement signed in 2015).

A. Goldthau and N. Sitter believe that the large, liberalised internal market of the EU and clearly defined competition rules oblige external participants to abide by them (Goldthau, Sitter, 2015, p. 1456). Failure to comply with EU antitrust law exposes market participants to sanctions and even to elimination from the market. Due to the strength of the EU market and the competencies of the European Commission in enforcing competition law (Kakol, 2007, pp. 136–160), the EU is strengthening its position as a regulatory power. This leads to an increase in its capacity to shape international market rules according to its preferences (Bach, Newman, 2007, pp. 830–832). To achieve this goal, the EU uses the concept of “wider Europe”, which consists of expanding influence by offering institutional cooperation to countries in the immediate vicinity, opening up greater opportunities to influence global politics (Lavenex, 2004). Liberalists are supporters of such argumentation, increasing the possibility of shaping the functioning of the global economic system by the EU. One of the best-known authors of publications exposing the normative power of the European Union by means of which it influences external relations and the world political and economic system is I. Manners, who has extensive scientific achievements in this field (Manners, 2006; Manners, 2002). A. Moravcsik and J. Nye emphasise that the EU pursues its foreign policy goals by promoting the idea of openness and initiating the development of multilateral institutions on a regional and global scale. They believe that the Union strengthens its superpower using ‘soft power’ (Moravcsik, 2019; Nye, 2005).

The transformation of the energy sector means the creation of a new, sustainable global economic order that ensures the maintenance of ecological and climate security, energy security, and fair use and management of global, regional and local common resources (Heinrich Boll Foundation, 2009, p. 26; Newell, 2009, p. 26). Therefore, changes in the energy sector have a wider dimension than ensuring production from low-carbon and renewable sources. They include

adjustments in the structures of national economies, geopolitical changes, and changes in international economic interdependence on a regional and global scale. Therefore, a question arises about the impact of the transformation of the energy sector on changes in the position of exporters and importers on regional and global markets for energy resources. An eminent expert in the field of energy, D. Yergin, claims that the existing system of entities and interests, which makes it possible to achieve large profits from the economy based on fossil fuels, will not easily give up its benefits (Yergin, 2008).

ENERGY CONSUMPTION – EU COMPARED TO OTHER MAJOR CONSUMER ECONOMIES

Compared to the EU, global energy consumption in the 21st century continued to grow exponentially (Figure 1). The average growth rate was 1.76% in 2001–2020 with declines in consumption only in 2009 (global financial and economic crisis) and in 2020 (Covid-19 crisis), when the decrease was the deepest (-4.28%). In the case of the European Union, energy consumption was, for the most part, stagnant or declining; thus, the average for the analysed period was -0.18%. The declines in consumption in 2009 (-5.41%) and 2020 (-6.61%) were much deeper than the global average. Looking at the leading energy consumers in the world (Table 1), the share of the EU decreased over time (by 6.79 pp) and fell from the second largest consumer in 2000 to the third position in 2020. Generally, the shares of developed countries continued to fall in the 21st century and were replaced by developing and emerging economies. China became the largest economy in terms of energy consumption, surpassing both the US and the EU. Its share in 2020 reached 26.1% and China was the only member of the G20 with an increase in energy consumption in 2020 (2.2%). The decrease in consumption is forecast to be short-lived, and consumption is expected to return to the 2019 levels in 2021. For the EU, the growth rate is expected to be 3.6% (Enerdata, 2021). Other countries that experienced growth of the global energy consumption shares are India, Iran and Korea. In 2000, the share of all Asian countries in the top 15 was 25.3%, while in 2020 it surged to 42.2%. These changes can be attributed to economic growth rates which were, on average, higher in Asia, particularly in emerging economies, as well as commonly used cheaper technologies, which increase the demand for energy and result in harming the environment and climate. On the other hand, in the developed world, noticeably the EU and the US, economic growth was slower, and, especially in the EU, efforts were intensified to improve the efficiency of energy resources and increase the use of renewable energies, which was reflected in the structure of consumption as well as external trade by source of energy.

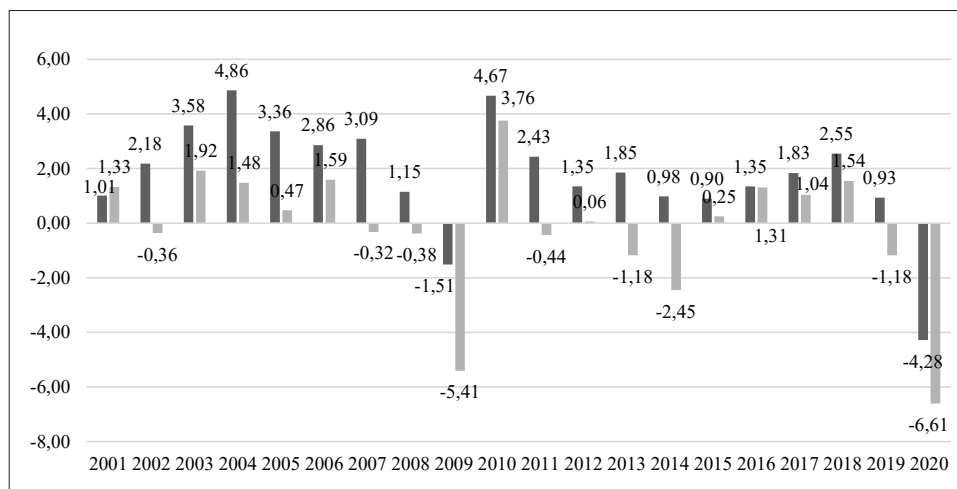


Figure 1. Growth in energy consumption in 2001–2020 globally and in the EU (in %)

Source: (BP, 2021).

From the point of view of sustainability and preventing unfavourable climate change, the most important trends should include the decrease in the use of fossil fuels and decarbonisation in particular, which means reducing the use of coal and, in exchange, increasing the use of renewable energy sources such as wind, solar, biofuels, etc. On a global scale, oil remains the main source of energy, although its share fell from 44.2% to 40.6% in 2018 (Table 2). A similar trend was observed in the EU – a drop from 45.8% to 41.1%, which is still above the global average. When it comes to decarbonisation, there were no positive changes on a global scale, since the share of coal actually increased in the period 2000–2018 (from 7.7% to 10%), while in the EU, the consumption of coal was limited – with a decrease from 4.4% to 3% – but was still higher than in the US (1.1%). Coal continues to be the major source of energy for China. Some decline was achieved in the analysed period, but it was still over 30% in 2018. The leading culprits for the growth in global coal consumption were: India, Indonesia and Japan (to a lesser extent).

Table 1. Leading energy consumers in the world in 2000, 2018 and 2020 (share in %)

2000		2018		2020	
Country	share	Country	share	Country	share
1	2	3	4	5	6
USA	22.00	China	20.70	China	26.10
EU-28	16.80	USA	16.00	USA	15.80
China	11.10	EU-28	11.60	EU-27	10.01

<i>1</i>	<i>2</i>	<i>3</i>	<i>4</i>	<i>5</i>	<i>6</i>
Russia	5.90	India	6.10	India	5.70
Japan	4.80	Russia	5.20	Russia	5.10
India	4.50	Japan	2.90	Japan	3.10
Germany	3.30	Brazil	2.30	Canada	2.40
Canada	2.70	Germany	2.20	Germany	2.20
France	2.30	Canada	2.10	Iran	2.20
Brazil	2.20	Iran	2.00	Brazil	2.20
UK	2.10	Korea	1.80	Korea	2.10
Italy	1.80	Indonesia	1.60	Saudi Arabia	1.90
Korea	1.80	France	1.50	France	1.60
Indonesia	1.70	Saudi Arabia	1.50	Indonesia	1.40
Mexico	1.40	Nigeria	1.40	UK	1.20
Iran	1.40	UK	1.30	Mexico	1.20

Source: (OECD, 2021; BP, 2021).

Regarding the use of renewable energy sources, the global share decreased during the analysed period (Table 2). This was mostly due to declines in renewables in China, India and Indonesia. The economies leading the pack in terms of renewable energy shares in their total energy consumption in 2018 were: Nigeria (with a share of 78.5%), Brazil (28.2%), and India (25.8%), of which the bulk majority were biofuels. The use of other renewables was scarce. The EU experienced progress in the utilisation of renewables, with the share growing from 4.3% in 2000 to 8.4% in 2018.

Preliminary data for 2020 (IEA, 2021), appear to be more favorable as the use of renewable energy in the world increased by 3% while demand for all other fuels decreased. This was mainly due to an almost 7% growth in electricity generation from renewable sources. All the problems that stemmed from the Covid-19 crisis were mitigated by long-term contracts, priority access to the grid, and continuous installation of new plants. Consequently, the share of renewables in global electricity generation jumped to 29% in 2020, up from 27% in 2019. Bioenergy use in the industry increased by 3%, but was largely offset by a decline in biofuels resulting from lower oil demand that limited the use of blended biofuels.

Table 2. Energy consumption structure by main sources in selected economies in 2000 and 2018 (in %)

2000							2018						
Economy	Coal	Oil products	Natural gas	Renewables and waste	Electricity	Heat	Economy	Coal	Oil products	Natural gas	Renewables and waste	Electricity	Heat
World	7.7	44.2	15.9	13	15.5	3.5	World	10	40.6	16.2	10.7	19.3	3
USA	2.1	51.3	23.3	3.5	19.5	0.3	China	30.9	26	7.5	5.5	19.3	5
EU-28	4.4	45.8	23.1	4.3	18.4	3.9	USA	1.1	47.6	23.9	5.6	25.1	0.4
China	35.1	22.8	1.6	25.5	11.4	3.3	EU-28	3	41.1	22.3	8.4	21	4.1
Russia	4.3	21.5	28	0.7	12.5	32.7	India	17.6	34.2	5.3	25.8	21	0
Japan	6.2	60.8	6.3	1.3	24.8	0.2	Russia	5.3	24.2	36.1	0.8	17	20.8
India	10.5	30	3.7	45.8	10.1	0	Japan	7.5	50.9	10.3	2.3	12.7	0.2
Germany	3.9	49.3	23.8	2.1	18	3	Brazil	3.5	42.9	5.9	28.2	28.7	0
Canada	1.9	40.7	28.5	6.3	22.1	0.4	Germany	3	40.2	25.6	7.1	19.4	4.3
France	2.1	50.1	19.8	5.6	20.4	2	Canada	1.3	46.1	25.1	5.3	21.9	0.3
Brazil	3.7	52.5	3.3	22.9	18	0	Iran	0.4	35.6	52.6	0.3	11.2	0
UK	2.9	41.5	34.8	0.4	18.8	1.6	Korea	5.2	52	12.3	2.5	25.1	3
Italy	2.1	48.4	30	1.4	18.2	0	Indonesia	9.4	47.3	10.7	17.3	14.1	0
Korea	7.1	62.8	8.6	1	17.8	2.6	France	1.3	43.7	19.3	8.3	25	2.4
Indonesia	3.8	38.2	9.6	41	5.7	0	S. Arabia	0	64.3	17.4	0	17.9	0
Mexico	0.9	64.1	13.2	8.6	13.1	0	Nigeria	0	17.1	2.8	78.5	1.6	0
Iran	0.4	60.1	30.8	0.1	8.6	0	UK	1.6	42.8	30.9	3.7	20	1

Source: (OECD, 2020; IEA, 2020).

EU'S EXTERNAL TRADE IN ENERGY SOURCES

The changes in the energy sector in the EU resulted in some shifts in the share of the European Union in world trade in energy commodities in 2000–2018. In the case of exports, the EU lost its leading position, with the share decreasing from 11.41% to 9.15%. Russia took over as the main exporter of energy resources (IEA, 2020). With the exception of the Netherlands and Spain, all other major EU economies (Table 3) had lower shares in total exports in 2018. In imports, the share of the EU increased considerably – from 25.8% in 2000 to 33.29% in 2018. However, most of the ‘big players’ experienced declines in their shares in world energy imports. Only the shares of the Netherlands and the UK grew slightly. The reason behind the increase in the share of the EU was Eastern enlargement followed by an economic boom in the new CEE member states, which also had much more energy-intensive industrial sectors.

Table 3. Share of the EU and selected member states in world exports and imports of energy resources in 2000 and 2019 (in %)

	Exports		Imports	
	2000	2018	2000	2018
EU	11.41	9.15	25.8	33.29
Germany	0.8	0.56	6.23	4.04
UK	3.39	1.29	2.35	2.47
France	0.79	0.56	4.3	2.64
Italy	0.58	0.52	4.61	2.64
The Netherlands	2.42	2.6	3.36	3.56
Spain	0.23	0.53	2.86	2.29

Source: (IEA, 2020).

When it comes to EU imports of energy resources, oil products remained the main category in 2019 with a share of more than 63%. However, some progress has been made because in 2000 the share was higher by nearly 5 pp. (Table 4). A similar trend can be seen in fossil fuel imports, which decreased their share from 9.40% in 2000 to 6.42% in 2019. The categories that increased their share in EU imports were as follows: natural gas (the highest increase – from 20.5% to 26.6%), renewables (from 0.1% to 1.4%) and electricity (from 1.8% to 2.3%). Improvement in the share of renewables is commendable; nevertheless, they remain the category with the lowest share of all of the analysed energy sources. In 2019, Scandinavian countries had the highest shares of renewables in their energy imports, Denmark (10.2%), Sweden (5.7%). In addition to that, high contributions of renewables to energy imports occurred in Latvia (8.9%). The UK share was

also well above the EU average (3.42%). On the other hand, the lowest shares pertained to Portugal (0.29%), Greece (0.36%), and the Netherlands (0.4%). Other large EU economies were situated in the middle of the pack, some slightly above or equalling the EU average – Italy (1.8%), Poland (1.7%), and France (1.4%) while others were below – Spain (1.3%) and Germany (1%). For the most part, all of them experienced growth in the share of renewables.

In terms of importing solid fossil fuels, they were still the most noticeable in CEE countries such as Poland (15.9%), Slovakia (15.8%), Czechia (12.6%), and also Germany (11.8%). Despite the positive changes on average in the EU, some member states actually increased the share of solid fossil fuels in their imports, most noticeably: Poland, Czechia, and Germany. The largest decarbonisation of their energy imports was made by: Denmark, the UK, Belgium, Portugal, and Romania. Other major EU economies halved their shares of solid fossil fuels (France, Italy, the Netherlands), reaching levels well below the EU average.

In the case of EU exports (Table 5), the main category, with a share of more than 70%, was oil and oil products. A slight increase in the share of this category occurred between 2000 and 2019. What can be considered to be positive changes are an increase in the share of renewables and biofuels (from 0.16% to 3.21%) and a decrease in the share of solid fossil fuels (from 8.77% to 2.83%). The most impressive shares of renewable energy in exports in 2019 were in the Baltics, in particular Latvia (62.5%) and Estonia (28.1%). When it comes to the ‘big players’, Germany and Spain also had above-average shares (8.4% and 7.2%), while the others had much lower percentages of renewables in their energy exports: France (2.8%), Sweden (2.6%), the Netherlands (1.1%), Italy (1.0%), and the UK (0.47%). Countries with the highest shares of solid fossil fuels were: Poland (50.6%) and Czechia (25.9%). However, in both cases, these shares were significantly lower compared to 2000. The third largest share in the EU of coal and other solid fossil fuels was in Germany (4.7% in 2019) and in this case, there was an increase in the analysed period (from 1.7% in 2000). Spain in 2019 reached a share of 3.4% (below the 2000 level) while the UK, the Netherlands, France, and Italy had less than 1% of their energy exports consisting of solid fossil fuels.

Table 4. Energy import structure in the EU in 2000 and 2019

Economy	2000					2019				
	Solid fossil fuels	Natural gas	Oil and petroleum products	Renewables and biofuels	Electricity	Solid fossil fuels	Natural gas	Oil and petroleum products	Renewables and biofuels	Electricity
EU	9.4	20.5	68.2	0.1	1.8	6.4	26.6	63.2	1.4	2.3
Belgium	11.1	17.5	69.9	0.1	1.3	3.7	21.9	71.8	1.3	1.2
Bulgaria	21.1	24.2	54.0	0.0	0.7	3.2	19.6	74.2	0.9	2.1
Czechia	5.8	41.9	48.1	0.0	4.2	12.3	32.7	49.3	1.7	3.9
Denmark	26.5	0.0	68.1	0.4	5.0	7.6	5.7	68.5	10.2	7.6
Germany	9.4	26.0	63.0	0.0	1.6	11.8	31.6	54.3	1.0	1.4
Estonia	3.4	34.1	47.4	0.0	1.7	1.1	14.6	66.7	2.2	15.2
Ireland	12.3	17.9	69.7	0.0	0.1	1.7	20.1	75.1	1.5	1.6
Greece	3.1	6.5	89.9	0.0	0.6	0.5	11.7	84.9	0.4	2.5
Spain	12.3	14.2	72.5	0.0	1.0	4.3	24.9	68.3	1.3	1.2
France	8.2	22.4	69.2	0.0	0.2	4.7	31.6	61.5	1.4	0.9
Croatia	8.0	15.2	70.5	0.0	6.3	5.6	20.6	60.2	1.4	12.2
Italy	7.6	27.0	62.9	0.3	2.2	4.3	38.3	53.1	1.8	2.5
Latvia	2.3	41.1	49.9	0.0	6.7	1.1	25.7	54.3	8.9	9.2
Lithuania	1.0	25.6	67.8	0.0	5.5	1.3	15.7	73.8	1.3	7.8
Luxembourg	2.9	18.0	64.2	0.0	14.9	1.0	15.5	67.1	3.2	13.3
Hungary	7.4	44.9	42.7	0.0	5.0	3.7	53.5	35.8	0.9	5.9
The Netherlands	6.4	9.8	82.2	0.0	1.6	3.3	21.2	74.1	0.4	0.9
Austria	13.8	24.0	56.2	0.6	5.4	8.4	35.8	46.3	2.6	6.8
Poland	3.4	22.3	73.3	0.0	1.0	15.9	23.1	56.9	1.7	2.4
Portugal	16.5	8.5	73.3	0.0	1.7	6.3	22.0	68.4	0.3	2.9
Romania	17.3	24.5	57.5	0.0	0.6	6.7	13.5	75.3	1.5	2.9
Slovenia	6.0	19.9	65.3	0.0	8.8	3.2	10.8	73.2	1.3	11.5
Slovakia	22.7	37.4	36.5	0.0	3.4	15.8	33.9	42.6	0.7	7.1
Finland	15.0	14.5	66.1	0.0	4.4	9.1	8.6	73.1	0.7	8.3
Sweden	7.5	2.5	84.9	0.0	5.0	6.3	3.2	81.9	5.7	2.5
UK	17.04	2.25	79.33	0.9	1.38	3.44	28.57	63.07	3.42	1.5

Source: (Eurostat, 2021b).

Table 5. Energy export structure in the EU in 2000 and 2019

	2000					2019				
	Solid fossil fuels	Natural gas	Oil and petroleum products	Renewables and biofuels	Electricity	Solid fossil fuels	Natural gas	Oil and petroleum products	Renewables and biofuels	Electricity
European Union	8.8	12.3	71.9	0.2	6.8	2.8	13.3	73.5	3.2	7.1
Belgium	4.4	0.0	93.1	0.0	2.5	0.2	9.8	85.5	1.2	3.3
Bulgaria	4.7	0.0	76.9	0.1	18.3	0.4	0.1	81.7	3.5	14.3
Czechia	68.2	0.0	12.8	0.0	19.0	25.9	0.0	34.6	7.3	32.1
Denmark	0.3	13.1	83.6	0.0	3.0	0.2	10.7	80.9	0.3	7.9
Germany	1.7	13.8	72.5	0.0	11.9	4.7	0.0	67.5	8.4	19.4
Estonia	4.5	0.0	45.1	1.5	36.3	0.6	0.0	62.1	28.1	9.3
Ireland	0.5	0.0	98.5	0.0	0.4	0.0	0.0	91.4	0.4	7.9
Greece	1.0	0.0	95.6	0.0	3.5	0.0	0.1	99.3	0.1	0.5
Spain	5.8	0.0	86.5	0.0	7.7	3.4	3.3	82.6	7.2	3.5
France	1.8	2.2	75.3	0.0	20.7	0.01	28.1	50.8	2.8	18.3
Croatia	0.0	0.0	95.6	0.0	4.4	0.0	1.9	75.4	8.1	14.6
Italy	0.4	0.2	99.2	0.0	0.2	0.7	0.9	95.7	1.0	1.7
Latvia	0.0	0.0	33.2	58.5	8.0	0.1	0.0	23.2	62.5	14.2
Lithuania	0.0	0.0	84.9	0.2	14.9	0.0	5.0	87.8	3.2	3.9
Luxembourg	0.0	0.0	24.4	0.0	75.6	0.0	0.0	4.5	14.3	81.1
Hungary	5.2	2.6	71.4	0.0	20.9	2.2	55.5	31.9	4.5	5.9
The Netherlands	0.4	32.2	66.9	0.1	0.4	0.1	23.8	73.8	1.1	1.2
Austria	1.5	0.5	48.9	5.4	43.8	0.4	29.4	35.7	9.7	24.8
Poland	86.1	0.2	9.6	0.0	4.1	50.6	3.9	36.9	4.3	4.2
Portugal	3.0	0.0	79.2	0.0	17.8	0.0	0.0	85.8	7.1	7.1
Romania	0.4	0.0	95.4	0.0	4.2	0.0	0.2	93.5	0.6	5.7
Slovenia	0.0	0.0	33.2	0.0	66.7	0.0	0.0	74.5	0.0	25.4
Slovakia	1.1	0.0	78.8	0.0	20.1	1.8	0.0	73.1	3.0	22.0
Finland	0.4	0.0	98.8	0.0	0.5	1.5	0.0	94.7	0.5	3.3
Sweden	0.2	0.0	90.3	0.0	9.5	0.2	0.1	77.1	2.6	20.0
UK	0.6	8.73	90.66	0.0	0.1	0.62	8.92	89.6	0.47	0.38

Source: (Eurostat, 2021b).

Energy import dependency measures how the share of total energy needs of a country are met by imports from other countries. A negative value indicates a net exporter. As can be concluded from Table 6, the dependence on energy imports in the EU did not improve in the period 2000–2019. The share of imported energy surpassed 60% in 2019, while in 2000 it was a little more than 56%. These data differ between member states, with the smallest economies naturally being the most reliant on imports (Malta, Luxembourg, Cyprus). Apart from these, others at the top of the list were: Italy, Belgium and Lithuania with over $\frac{3}{4}$ of energy consumption coming from overseas. On the other hand, Estonia was almost self-sufficient when it comes to its energy needs with only a 4.8% dependency on imports. Other countries with relative energy interdependence were: Sweden, Romania, Bulgaria, the UK and Denmark. Germany (67.6%), the Netherlands (64.5%) and France (47.6%) were situated in the middle of the pack in terms of import dependency, but the first two regressed in this respect in comparison with the year 2000, while France became slightly more import independent.

**Table 6. Dependence of energy imports in the EU in 2000 and 2019
(% of total energy demand)**

Economy	2000	2019
<i>1</i>	<i>2</i>	<i>3</i>
European Union	56.28	60.70
Malta	100	97.17
Luxembourg	99.60	95.13
Cyprus	98.63	92.81
Italy	86.52	77.48
Belgium	78.16	76.68
Lithuania	57.78	75.22
Spain	76.80	74.96
Greece	69.06	74.11
Portugal	85.29	73.85
Austria	65.54	71.73
Slovakia	65.07	69.76
Hungary	54.98	69.70
Ireland	85.43	68.4
Germany	59.44	67.61
The Netherlands	38.27	64.72
Croatia	48.45	56.22
Slovenia	51.85	52.14
France	51.25	47.60
Poland	10.72	46.82

<i>1</i>	<i>2</i>	<i>3</i>
Latvia	61.01	43.96
Finland	55.48	42.09
Czechia	22.7	40.89
Denmark	-35.92	38.78
Bulgaria	46.41	38.10
UK	-17.13	34.83
Romania	21.88	30.37
Sweden	39.32	30.24
Estonia	33.77	4.83

Source: (Eurostat, 2021a).

Looking at other changes between 2000 and 2019, some member states improved their dependence on imports, most notably: Estonia, Italy, Ireland, Latvia, Finland, Bulgaria, and Sweden. But in the majority of cases, the energy imports dependence deepened. Denmark and the UK turned from net energy exporters into net importers. Other countries with the highest increases in energy import dependency were: Poland, the Netherlands, Czechia, Lithuania, and Hungary.

DISCUSSION

The negative consequences of increasing energy consumption have resulted in intensified discussion of IPE representatives, which highlight the need for energy transformation. Thus, they see a need for a new conceptualisation of both the economic and political roles of energy. They provide the grounds for the new definition, for the sake of the contemporary energy policy, of the essence of what energy is, the kind of product it is, and what sort of needs it meets as well as how energy security should be understood under the current conditions. The discussion often focuses on the conceptualisation of energy policy, whose efficiency depends on the degree of its internationalisation since this is a prerequisite for solving the global issue of climate change. In this respect, what attracts a lot of attention is the external policy of the EU, the role of the common energy market, and clear rules of competition law that oblige external participants on the market to comply with them as well. The power of the EU market and the concept of a ‘wider Europe’ increase the opportunities of the EU to impact global energy policy. IPE theorists emphasise that current changes in the energy sector do not provide production based on low-emission and renewable sources. Therefore, the authors formed a question regarding the impact of energy sector transformation on changes in the position of exporters and importers on regional and global energy markets.

The predominant opinions in the empirical literature say that the transition of the energy sector and preventing climate change and environmental degradation are possible through communication between major producers and consumers of energy. It requires careful consideration of whether the contemporary system of international institutions and the G20 countries have enough decision-making authority to broker a consensus under the crisis political conditions and the immense diversity of economic goals. To date, prevalent views stated that the economic potential and market power of the EU constituted the greatest opportunity to revolutionise energy policy and achieve a transition to renewables, provided that the plan to create an energy union was fulfilled, which would eliminate any ability to carry out autonomous energy policy at the level of the member states.

Why then was the European Commission not able to make progress with the concentration of energy policy at the supranational level? The first of the main reasons was the vertical integration of energy companies favouring dialogue and implementation of their business goals relying on the support of national authorities, at a bilateral level (Talseth, 2017, p. 256). Another obstacle in accomplishing the EU-wide community of goals in energy policy was the varied dependence of member states on natural gas and oil imports from Russia, as A. Schmidt-Felzman emphasised (Schmidt-Felzman, 2019, p. 143). A considerable stumbling block in the implementation of the energy union originated from the conflict around Nord Stream 2 and the differentiation of the position of the member states in this matter. Germany, Austria and France highlighted the benefits of the project for the energy security of the entire EU (Schmidt-Felzman, 2019, p. 143; Mucha-Leszko, Białowas, 2020, p. 275).

E. Molendowski makes a profoundly interesting remark pointing to the fact that EU trade with Russia is based on an inter-industry division of labour, while it is the intra-industry trade that incorporates the market participants into international value chains (Molendowski, 2017, p. 73).

A group of researchers can also be recognised in the scientific literature that believes that the capacity to carry out a global transformation of the energy sector lies within the greater commitment of the European Union to the development of the common external energy policy. They take into consideration the potential and impact of the EU energy market on the external environment. Representatives of liberals point to the market and trade as major powers of influence on outside markets (Damro, 2012, pp. 682–699; Meunier, Nicolaidis, 2006, pp. 906–925). A different approach points to the normative power of the EU which entails diffusion of norms and institutions of the integrated EU market by example rather than by the traditional coercive power (Hardwick, 2011). The concept of a wider Europe could be seen as an attempt at materialising this approach. It includes offering institutional cooperation to countries outside of the EU in order to expand territorial interdependence and create new opportunities for the implementation of

the global policy (Lavenex, 2004, pp. 680–700), which also pertains to the global energy transition. The precondition for making that a reality is to establish the energy union within the EU.

The authors believe that in the current situation, the objectives of the transition of the energy sector of the EU can only be achieved under the conditions of reducing the dependence on Russian energy commodities and in close cooperation with the United States.

CONCLUSIONS

Addressing the objective of the paper and the delineated research questions, first, we will answer the question of whether the EU as a leader in the transformation of the energy sector managed to achieve any progress in 2000–2020 in reducing energy consumption and transitioning to renewable energy sources, directly reducing the threat of further climate and environmental changes. According to the research carried out in the paper, over the past 20 years, energy consumption in the EU continued to decline – by 0.18% per annum, which was a considerable improvement against the backdrop of the global increase in energy consumption by 1.76% per year. The following factors had a significant impact on the level of energy consumption: economic growth and investments that reduced the energy intensity of the economies of the member states. Global consumption kept rising mostly due to high economic dynamism in China, India and the transition economies, as well as their low efficiency of energy technologies. As a result, in the analysed period, the EU28's share of global energy consumption dropped from 16.8% to 10.01%, the USA – from 22.0% to 15.8% and it increased in China from 11.1% to 26.1% while in India from 4.5% to 5.7% (Table 1).

In the case of energy consumption structure by sources, it should be noted how the composition of energy sources changed (Table 2). Decarbonisation was not an issue by the end of the second decade, neither in the EU nor in the USA, nor even on a global scale, although the share of coal as an energy source grew from 7.7% (2000) to 10.0% (2018). Coal-based energetics is predominant in China. Asia contributed in a noticeable way to the deterioration of the coal share in energy production worldwide and the situation worsened in the analysed period 2000–2018. The share of Asia in coal-based energy increased from 63.1% to 71%. Other contributors to this increase were India, Indonesia, and even Japan (Mucha-Leszko, Kąkol, Angowska, 2022, p. 10). Admittedly, China managed to reduce the share of coal as an energy source by 4.2 %, but it still remained relatively high (30.9%) compared to India, Indonesia and Japan.

The goal of the paper is also to evaluate the transformation of the EU energy sector towards a wider use of renewable energy sources. An increase of

4.3% to 8.4% over a period of 19 years does not allow this change to be considered a significant achievement in terms of decreasing the use of traditional energy sources. Thus, the EU energy sector transition is still in its initial stage. However, another trend appears to be worse. In 2000–2019, there was an expansion of the EU's dependence on imports of energy resources as a whole, and in particular, this pertained to the economies of considerable significance such as Germany, the Netherlands, Poland and Austria. The high dependence on imports of traditional energy commodities was also characteristic of Italy and Spain, as well as some smaller economies (Belgium, Portugal, Slovakia, Hungary and Ireland). In this sense, the question of the impact of energy sector on the changes in the structure of EU energy exports and imports by source is raised and considered the top 10 largest exporters and importers of energy commodities. The composition of energy sources in both exports and imports consists mostly of traditional energy sources: natural gas, crude oil, and oil products. On the other hand, some changes occurred in the largest exporter ranking. Russia became the largest exporter of energy sources, surpassing the EU. Some changes can be noticed in the group of top importers, but the EU remains the largest energy source importer in the world.

Due to the concentration of traditional energy sources in a limited number of countries and the specifics of the contemporary balance of economic powers, which includes several centres that make up the global centre of trade and investment flows, the concentration of imports and exports of energy sources remains high as well. In the first two decades of the 21st century, Russia reinforced its position as an exporter of energy commodities. It became the world's leading exporter and the main supplier of natural gas, crude oil, oil products, and coal to the EU (OECD, 2020). The major predicament of the EU is the high dependence on energy deliveries from Russia. This was strongly emphasised in 2014 after the annexation of Crimea. But some time has passed and, despite the publication of the energy union package and roadmap by the European Commission, the implementation of the concept of the energy union has not been stepped up. Until Russia's military attack on Ukraine on February 24, 2022, the EU countries had not reached a consensus on the matter of future energy relations with Russia. Fragmentation of the EU market was convenient for Russia both in economic and political terms. The ability to sign bilateral agreements, which was particularly supported by Germany and France, but also by large European corporations, offered Russia additional opportunities for economic and political gains. Under the conditions of high volatility of energy commodity prices, European companies signed long-term contracts on natural gas deliveries from Russia up to 2035 (Belyi, 2015, p. 112). For Russia, this meant stable demand and income from exports.

Implementing the concept of the energy union remains a crucial action from the point of view of the European Union that will help stabilise the situation on the energy markets, both in Europe and globally. In recent years, Russia's position in

oil and gas exports, as well as its established transportation network toward Asia and the new pipeline projects bypassing Ukraine, offered new opportunities for it to demonstrate geopolitical power and diversify its oil and gas export markets (Siddi, 2018, pp. 1559–1562). Putin's regime has been actively positioning Russia as an antagonist of the West, Europe and the United States at both the domestic and international levels (Kuteleva, 2020, p. 88). The direction towards destabilisation of political relations in the world was confirmed by the attacks in Ukraine. Well-known energy expert D. Yergin (Yergin, 2006, pp. 1012–1016) claims that actors and stakeholders who profit from an economy based on fossil fuels (states and participants in the energy market participants) will not easily give up their benefits.

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Summary

The purpose of the paper is to investigate the multifaceted impact of the transformation of the energy sector on domestic economies and international economic relations under the conditions of growing global interdependence. The authors formulate the following research question: What were the changes in the consumption and structure of generating energy, as well as the structure of exports and imports of energy sources, resulting from the transformation of the energy sector in the EU?

The following methods were used. The theoretical analysis of the energy sector transformation is based on an interdisciplinary approach proposed by representatives of the International Political Economy. The empirical analysis uses the following indicators: growth rates of energy consumption, shares of selected countries and the EU in the global energy consumption, shares of major sources in the consumption of energy in selected economies, shares of major energy sources in exports and imports of the EU and its member states.

Considering the achievements of the EU's energy policy focused on decreasing the consumption of energy and departing from traditional sources (especially coal) to renewables, the authors concentrate on the results and consequences of the energy policy in the EU. It revealed that the EU had better results on the global scale in limiting energy consumption in 2000–2020. However, the transformation of the energy sector that leads to greater use of renewables is still in the initial stages. Oil and natural gas remain the main sources of energy consumption.

When evaluating the impact of transformation on EU energy trade, the dependence on high energy imports in the EU is notable, which actually increased in 2000–2019 from 56.3% to 60.7%. The structure of the imports remained basically the same. The share of oil and natural gas increased slightly, from 88.7% to 89.8%, and the share of renewables climbed from 0.1% to 1.4%. An unfavourable change from the point of view of EU energy policy is the growing share of solid fossil fuels, which was, for the most part, caused by imports to Poland, Slovakia, Czechia and Germany. The structure of exports was quite stable, with oil and natural gas as dominant sources (73.5% and 13.3%, respectively). However, the share of solid fossil fuels in EU exports decreased from 8.8% to 2.8% (2000–2019), which is a positive trend.

Keywords: energy consumption, diversification of energy sources, changes in EU exports and imports.

Transformacja sektora energii i jej wpływ na handel zewnętrzny Unii Europejskiej surowcami energetycznymi w latach 2000–2020

Streszczenie

Celem pracy jest przedstawienie wieloaspektowego wpływu transformacji sektora energetycznego na gospodarkę krajową i międzynarodowe stosunki gospodarcze w warunkach rosnącej współzależności globalnej. Autorki sformułowały następujące pytanie badawcze: Jakie zmiany transformacja sektora energetycznego UE spowodowała w konsumpcji i strukturze źródeł pozyskiwania energii oraz w strukturze importu i eksportu surowców energetycznych?

W pracy zostały wykorzystane następujące metody badawcze. W analizie teoretycznej problemu transformacji sektora energii zostało zastosowane podejście interdyscyplinarne oparte na metodach stosowanych w międzynarodowej ekonomii politycznej. W analizie empirycznej wykorzystano wskaźniki wzrostu konsumpcji energii, wskaźniki udziału krajów i UE w globalnej konsumpcji energii, wskaźniki udziału źródeł energii w konsumpcji energii w wybranych krajach i UE, wskaźniki udziału głównych surowców energetycznych w imporcie i eksporcie UE i jej krajów.

Ze względu na osiągnięcia Unii Europejskiej w polityce energetycznej zorientowanej na obniżanie konsumpcji energii i odchodzenie od tradycyjnych źródeł energii (zwłaszcza węgla) na rzecz źródeł odnawialnych, autorki skoncentrowały analizę na wynikach polityki energetycznej i jej następstwach w UE. Wynika z niej, że UE osiągnęła najlepsze rezultaty w skali globalnej w latach 2000–2020 w obniżaniu konsumpcji energii, natomiast transformacja sektora energii w kierunku wzrostu udziału surowców odnawialnych jest w początkowym stadium. Nadal głównymi źródłami konsumpcji energii pozostają ropa naftowa i gaz ziemny.

W ocenie wpływu transformacji sektora energetycznego na handel UE podkreślono wysoką zależność krajów UE od importu surowców energetycznych i w latach 2000–2019 ona wzrosła z 56,3% do 60,7%. Struktura importu surowców energetycznych w UE w zasadzie nie zmieniła się. Udział ropy naftowej i gazu ziemnego wzrósł z 88,7% do 89,8%, a udział odnawialnych źródeł energii wzrósł z 0,1% do 1,4%. Zmiana niekorzystna z punktu widzenia polityki energetycznej UE to wzrost importu stałych paliw kopalnych, na co istotny wpływ miał wzrost importu Polski, Słowacji, Czech i Niemiec. Nie zmieniła się też istotnie struktura eksportu UE – dominuje ropa naftowa i gaz (73,5% i 13,3%). Pozytywną zmianę stanowi spadek udziału w eksporcie stałych paliw kopalnych z 8,8% do 2,8% (2000–2019).

Słowa kluczowe: konsumpcja energii, dywersyfikacja źródeł energii, zmiany w eksporcie i imporcie UE.

JEL: O13, Q01, Q43, F02, F10.