REPORT

CONDITIONS FOR BUILDING STABILITY IN ENERGY SECURITY BY MAKING IT INDEPENDENT OF CHANGES IN THE GEOPOLITICAL ENVIRONMENT.
THREATS AND THE FUTURE

ODOKA.

”Conditions for building stability in energy security by making it independent of changes in the geopolitical environment. Threats and the future.”

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REPORT’S CONCLUSIONS.

– Decision-making in the EU should be based on reasoned arguments and be immune to lobbying by individual external stakeholders, often unfavourable to rational solutions.

– It is necessary to make EU climate policy more realistic and to reform, among other things, the Emissions Trading System (EU ETS) so that it takes account of local circumstances in a stable way and ensures the development of zero-carbon emission investments rather than placing an additional burden on energy prices and business development.

– As part of a broadly understood security and climate policy, research into new technological solutions should be increased in scope and quantity.

– The European Union should aim to create the conditions for participation in legislative processes and other decision-making by ensuring the fair involvement of the representatives of the business groups, citizens and other stakeholders.

– The many years of neglect in the area of planned restructuring and development of the NPS, as a result of sudden geopolitical changes, have manifested themselves in an extreme accumulation of critical challenges that require solutions to be implemented simultaneously over the next 10 years.

– The only energy fuel for the transition is price-volatile natural gas, which must be imported via the only available route: maritime transport (LNG terminals and the Baltic Pipe pipeline). This state of affairs raises the need to prioritise increased protection of this distribution channel.

– Due to omissions in the development of transmission and distribution networks and the adaptation of energy market rules, the Polish NPS is not able to absorb a larger amount of relatively cheap energy from RES (between 2015 and 2021. DSOs refused to connect generation installations with a total capacity of approximately 30GW for technical reasons. Including 3 751 refusals in 2021 alone).

– Around 50% of the country’s transmission and distribution infrastructure is over 40 years old. This state of things contributes to an increased sensitivity of the grid to overload failures and weather conditions. Paradoxically – the increasing number of distributed generation sources (mainly PV) increases the grid’s sensitivity to disturbances.

– There is a necessity to complement the definitions and assumptions of the “European Green Deal” with an awareness of the of reducing the consumption of our own fossil resources with the absolute

priority of preserving the technical ability to obtain them in the future. In the future, these resources can be a source of pure value using technologies not available today.

– It is important to bear in mind that the fossil fuel crisis has two faces: as a crisis of costs and availability of fuels (heat extraction in combustion processes) and of production inputs (conversion of fossils into chemical intermediates and products such as synthesis gas, fuels, construction components, fertilisers).

– One of the multidimensional priorities should be the area of development of hydrogen technologies, which can act as both pure energy storage and sources of raw materials for chemical synthesis (fertilisers, fuels, etc.).

– There is an urgent need to implement transitional formal and legal regulations, which will enable the systematic development and integration of low-cost energy sources into the grid, while at the same time systematising the legal status regarding the development of energy storage technologies, which will increase the possibility of balancing the system (increasing the effectiveness of NPS operation by abandoning the obligation of exchange sale of energy and enabling direct market transactions between energy producers and consumers).

– It is essential that steps are taken towards the efficient and formally risk-free construction of large-scale sources of carbon-free nuclear power, which will provide a baseline level of power generation in the system.

– The need to establish the right dialogue with technology suppliers, solution developers and contractors by developing a complementary strategy for dynamic modernisation of the energy sector, complemented by a coherent implementation plan to harness the large technical potential of the business sphere present in the market. Domestic companies have a huge potential of experience and technical capabilities, which, used in the right way, can become a guarantee for the successful implementation of ambitious challenges.

Chapter 1:

Principles, mechanisms and foundations for European Union decision-making in energy matters.

1.1 The European Union’s economic model and climate strategy as part of its energy security policy.

The extent of the challenge in defining an energy policy for the European Union is set out in the preamble to the General Principles and its objectives. The document reads, among other things: “Challenges facing the EU in the field of energy include issues such as increasing import dependency, limited diversification, high and volatile energy prices, growing global energy demand, security risks in producing and transit countries, growing threats of climate change, decarbonisation, slow progress in energy efficiency, challenges posed by the increasing share of renewables, and the need for increased transparency, further integration and interconnection in energy markets. A variety of measures aiming to achieve an integrated energy market, security of energy supply and a sustainable energy sector are at the core of the EU’s energy policy.”[1]

Over the period 2015 – 2023, the targets have been updated several times. The most recent update of the targets, dated April 18, 2023, includes a further expansion of the range of activities designed to enable the targets to be achieved:

- Free allowances in the Emissions Trading System (ETS) to be phased out from 2026
- Road transport and buildings in new ETS II from 2027
- New carbon leakage instrument to protect EU industry and increase global climate ambition
- A Social Climate Fund to combat energy and mobility poverty[2]

The dynamic changes in the geopolitical environment in recent times are forcing a redefinition of climate policy objectives. This thesis should even be taken a step further: it seems justified to define a new strategic objective, which is becoming energy security. The right economic model and climate objectives are its derivative. Such a configuration does not mean degrading the climate aspect. It is a logical realignment of priorities due to the fact that a sense of security will allow the creation of realistic

[1] Article 194 of the Treaty on the Functioning of the European Union (TFEU).
[2] https://www.europarl.europa.eu/news/en/press-room/20230414IPR80120/fit-for-55-parliament-adopts-key-laws-to-reach-2030-climate-target

higher-order goals, which only in this configuration will gain proper public support. This aspect must not be overlooked, since the ability to continue the adopted strategy and tactical actions in the long term, in democratic societies, significantly depends on public acceptance in democratic election cycles. The fight against climate change (second-tier strategic objective) should be a direct function of actions aimed at ensuring energy security (first-tier strategic objective) through carbon-free sources, the development of which is stimulated by the aim of reducing the use of our own fossil resources (tactical objective). A series of contradictions regarding the fight against climate destruction might as well become the unofficial motto of the European Union’s actions. Despite many efforts and important EU initiatives, global CO_2 emissions have been steadily increasing since countries first committed to stopping climate change at the Earth Summit in Rio de Janeiro in 1992 – despite dozens of climate summits and global climate agreements concluded in Kyoto and Paris. In the last ten years, Europe and the world have focused more than ever on tackling climate change. The identification of tactical failures of climate policy, coupled with the degree of awareness achieved of the proper categorisation of strategic objectives, should compel a series of reforms to increase the effectiveness of action.

The European Union, with its complex organisational structure consisting of legal regulations, customary norms, decision-making procedures, as well as the institutional system and relations between the various participants in the political processes, is an organism whose effective operation requires the proper organisation of cooperation mechanisms in order to achieve results in line with its declared objectives. It could be relatively easy to achieve high governance efficiency by fully unifying all activities in a full integration process and by abandoning the intergovernmental method. Such a radical solution, however, is unlikely to be accepted by the respective member countries. Another solution, which is much more feasible and aims at improving the integration process, is to apply the Multi-Level Governance (MLG) approach. Specifically in relation to energy policy implemented in the EU dimension. One characteristic of this approach is the assumption that the European Union is a construct made up of many decision-making levels. These should interact effectively with each other.[3]

Multi-level governance is a kind of ’modus operandi’ that the EU uses in terms of how it pursues its treaty objectives. According to the concept of multi-level governance, the integration process is supposed to run more smoothly, the political mechanisms are supposed to function more harmoniously and the individual participants in the political system are supposed to feel that they are the real decision-makers in the system of political decision-making. The European Union, despite the

[3] K.Tomaszewski. “Multi-level governance in the EU energy policy”, Warsaw 2018.

positive attitude of the respective member countries towards the concept of multi-level governance, is not making full use of the opportunities that this model offers with regard to the development and management of energy policy.

Working towards more effective integration is a key factor in determining the future of the European Union. The search for appropriate forms of governance therefore became a natural challenge for Europe’s political elites. It was an important factor in enabling the European Union to develop further. Moreover, the EU, as an organisation, had to face new challenges:

- the increasing complexity of the issues that came under the administration of the European Union, which required new political solutions;
- crisis of traditional administration and government;
- the complexity of the distribution of competences between the national and supranational level;
- the need for more effective legitimacy of the Union’s actions, especially in the sphere of law-making involving citizens.

Governance in the European Union should not only focus on the mere democratisation of the ways in which politics is conducted, but should first and foremost include functional ways of identifying and solving problems that arise from the coexistence of different collective parties expressing different aspirations and expectations. The choice of the Multi-Level Governance model responds to the problems of democratic deficit in the European Union and effectively legitimises its actions. It is particularly important to include those acting at different levels of government in governance processes by ensuring that their representatives can influence decision-making processes. This inclusion is not elitist and implies the possibility for diverse parties to participate in decision-making processes under certain conditions. A fundamental issue is the level of organisation of national parties, which translates into real opportunities for political influence.

The MLG model provides an opportunity to influence political processes, but this is much easier when concerned parties are able to organise themselves effectively and act collectively as a coherent coalition of interests. Their potential of influence on the final shape of the projects undertaken depends on this. Such a situation may seem unfavourable from a democratic point of view, as it means that, in theory, the interests of parties unable to organise themselves are overlooked. Nevertheless, from the point of view of the efficiency of governance, such a mechanism seems justified, as it

safeguards the system against complete paralysis of decision-making processes. In practice, the strongest players who can block decision-making are the respective member countries. However, it is in their interest to seek constructive solutions rather than to suppress the actions of the Union as an organisation.

The main focus of action to ensure the availability of flexible sources of carbon-free (or low-carbon in the interim) energy is currently the plans for the construction and expansion of large-scale sources of both nuclear and RES (mainly converting sunlight and wind, and to a lesser extent geothermal energy, hydropower and energy derived from biomass and biogas). Innovative energy sources such as hydrogen-based technologies and small-scale innovative nuclear reactor solutions of medium and small capacity are also being intensified. Despite being burned, biomass and biogas do not disturb the carbon balance available on the Earth’s surface, which is in circulation anyway. Despite the fact that these sources generate certain nuisances, their key feature is the possibility of managing most of the generated risks. This fact stands in contradiction to sources generating energy from the combustion of fossil fuels, where, despite increasingly advanced exhaust fumes cleaning technologies, it is not possible to completely capture their main component – CO_2. This state of affairs necessitates the dispersion of huge quantities (both in mass and volume) into the atmosphere, and a common method of limiting its impact on the immediate environment is dispersion by using high chimneys above ground level. Carbon dioxide is the primary greenhouse gas with GWP (Global Warming Potential) = 1. CO_2 is a chemical compound whose GWP is a reference value at scale. However, due to its dominant quantitative share, among the full range of greenhouse gases, the set of necessary measures to weaken the impact of GHGs (Greenhouse Gases) is called decarbonisation. In doing so, it is important to bear in mind that action to reduce the impact of GHGs on climate change must be carried out in a complementary manner.

Complementarity in designing the component processes of the energy transition is a prerequisite for properly defined objectives. It manifests itself primarily in the development of a strategy that is coherent from the point of view of the entire NPS:

- production;
- transmission;
- distribution;
- storage methods – ensuring sustainability;
- network management and control automation for increased operational efficiency.

Each country faces different challenges on the road to transition, due to the current structure of the energy system. The European Union’s common energy security policy, with its economic and climate objective and climate objective, should be developed on the basis of the above-mentioned multi-level governance model, taking into account the specific conditions of each member country.

The rapid increase in the share of renewable energy in electricity systems poses a serious challenge to the paradigm of National Power System management, which will gradually change towards a significant supplementation of central dispatching of generation sources by coordinating the operation of integrated resources in supply-demand balancing. The change in the idea of managing the operation and supervision of the NPS forces specific legislative changes and investments towards the development of methods of large-scale energy storage and management of dispersed installations.

In 2021, the share of electricity in global energy consumption increased by 0.2 percentage points to reach 20.4% globally. The share of electricity in final consumption has been growing rapidly since 2010 by an average of 0.29 points per year, as an increasing share of electricity is consumed in the industrial, residential and tertiary sectors, and more recently in the road transport sector with the development of electric vehicles. Some countries have seen sharp increases in the share of electricity in final energy consumption, such as China (+10 percentage points since 2010, including +1.6 percentage points in 2021 alone) seeking to reduce its dependence on coal by promoting RES and building more nuclear generating units, Indonesia (+7.2 percentage points since 2010, thanks to reduced use of biomass), or India (+4.4 percentage points since 2010). The share of electricity in final energy consumption has also increased since 2010 in Mexico, Argentina and Saudi Arabia, while it has decreased to a lesser extent in South Africa and Russia. The share of electricity in final consumption is particularly high in Norway and Sweden, which use large hydro resources (47% and 33% respectively).[4]

[4] https://yearbook.enerdata.net/electricity/share-electricity-final-consumption.html

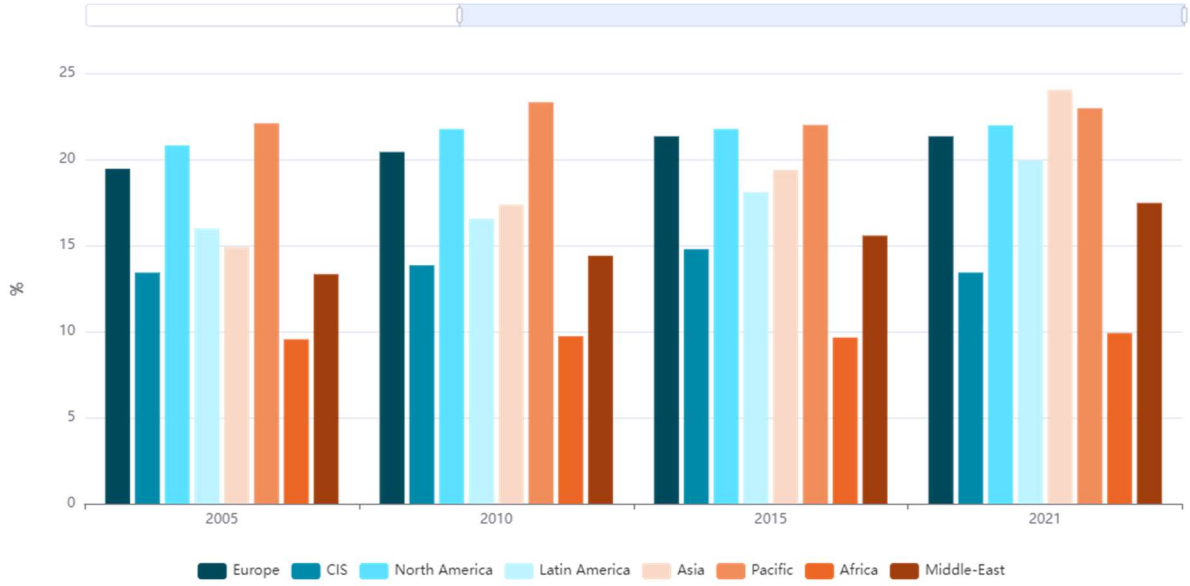

Fig. 1. The percentage share of electricity consumption in relation to total global energy consumption over the period 2005 – 2021.

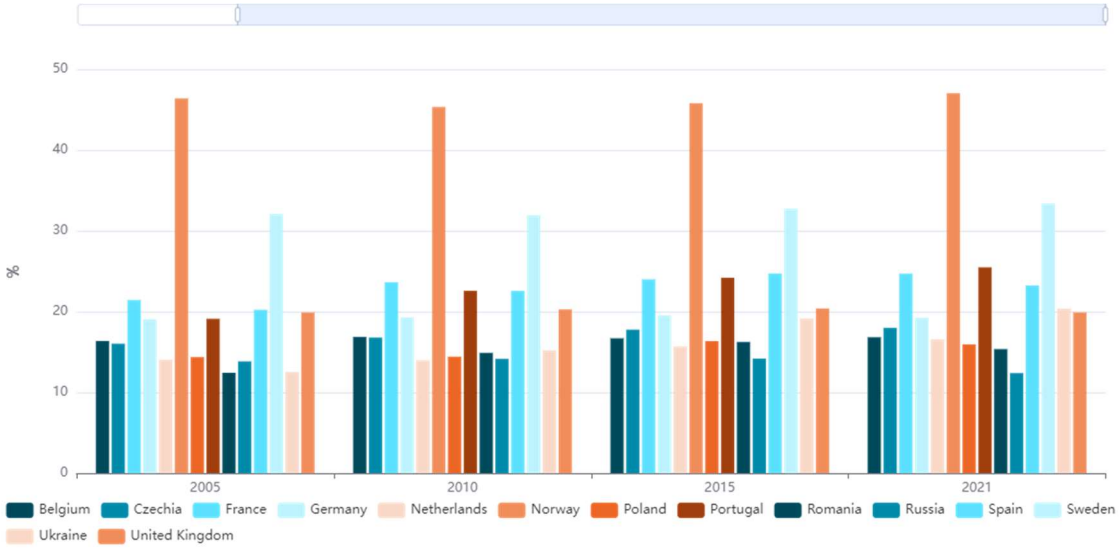

Fig. 2. The percentage share of electricity consumption in relation to total European energy consumption over the period 2005 – 2021.

Most of the commitments made in Rio de Janeiro in 1992 and Kyoto in 1997 have not been fulfilled. A 2018 study found that only around 10% of the countries that pledged to reduce emissions in Paris had enacted laws mandating the required action. Even if all countries had implemented the commitments in the original Paris Agreement, the emissions reductions by 2030 would represent only 1% of what is needed to stop the global average temperature from rising above 2°C. The above data prompts us to recommend immediate decision-making towards redefining the objectives (as strategy) and

implementing solutions (as tactical actions) to achieve the goal. The national power system requires immediate regulatory changes followed by investments in expansion that will increase its flexibility and adapt it to a higher share of renewable energy. Changes should include, among other things, allowing the construction of direct lines (which is the subject of the draft law amending the Energy Law, passed by the Polish Parliament at its session on 16 June 2023), as well as the sharing of distribution cable capacity by different generation sources (cable pooling), increasing the role of Distribution System Operators (hereinafter: DSOs) in managing energy flows in the grid, and introducing a legal framework and encouragement for flexibility services. Despite the unadapted administrative and legal conditions, interest in the construction of other new RES sources, in particular photovoltaic installations, is not waning. At the end of 2021, the number of all micro-installations (most of the connected micro-installations are photovoltaic installations, which are mainly private installations) connected to the distribution network was 854,000, with 396,000 connected in 2021 alone, while already in March 2022, the number of micro-installations connected to the DSO network exceeded one million. However, the pace of change was not withstood by the electricity grid, as proved by the scale of refusals to connect generation installations. According to data published by the President of the Energy Regulatory Office, the number of connection refusals in 2021 increased by 70% compared to 2020 and reached as many as 3751 cases, mainly consisting of RES installations.

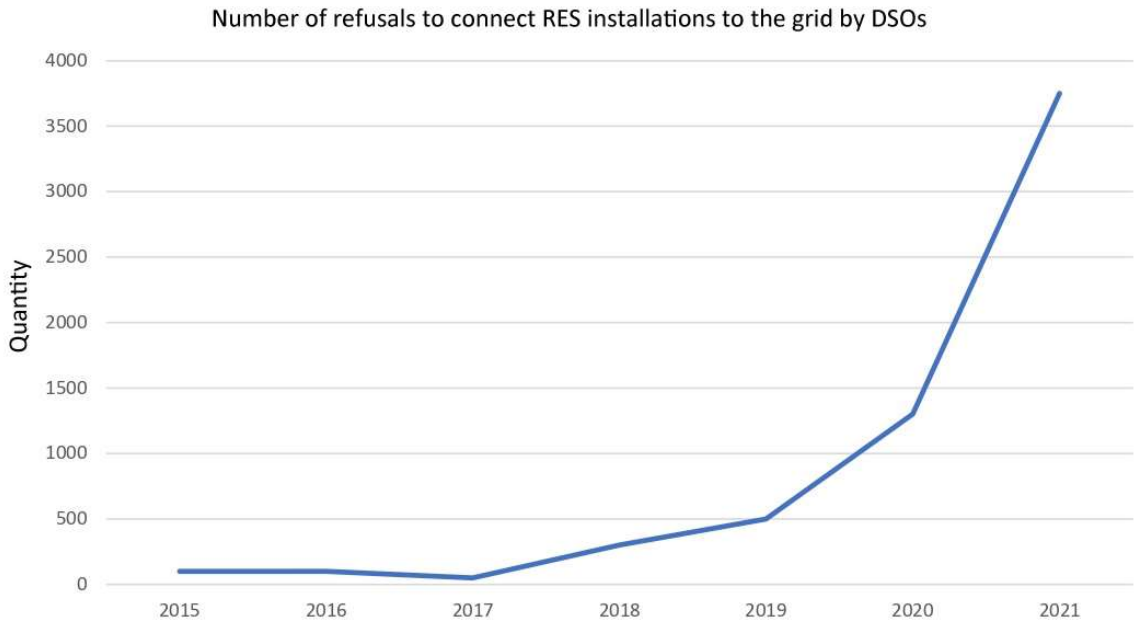

Fig. 3. Number of refusals to connect RES installations to the grid by DSOs between 2015 and 2021.[5]

[5] https://www.ure.gov.pl/pl/oze/potencjal-krajowy-oze/8108,Instalacje-odnawialnych-zrodel-energii-stan-na-31-grudnia-2021-r.html

The above-mentioned arguments suggest that the key actions that will enable further development and growth of connected RES capacity currently are work on formal and legal conditions enabling the implementation of transitional solutions to ensure technical overcoming of development barriers and intensification of network investments. The growing need to invest in energy networks is also noted by the European Union in the European Commission’s plan to make Europe less dependent on fossil fuels in the wake of the Russian invasion of Ukraine (REPowerEU). The European Commission intends to mobilise funding to support a wide range of investments that will contribute to the REPowerEU policy objectives by accelerating the lending process, combining and preparing advisory products for renewable energy sources, energy efficiency and the energy grid. Funds for grid investments are to be provided from the National Reconstruction Plan (NRP), which assumes that 320 km of electricity grids will be financed thanks to the funds received from the EU. From the perspective of efficient use and development of the grid, the following legislative changes are desirable:

- the granting of wider competences to DSOs in terms of electricity system management;
- DSOs should be equipped with the right tools to enable them to effectively manage the system, the demand and flexibility services;
- simplification of the grid connection process by providing a harmonised, structured and transparent connection process;
- Providing Distribution System Operators with instruments to upgrade the grid within a certain time frame if connection of a micro or small RES installation is refused.

1.2. Energy price formation mechanisms.

Poland, as a member of the unified European energy market, which operates under the same rules in all countries, applies consistent pricing principles. By definition, this means that under the current rules, foreign parties can import energy from Poland and Polish parties can import energy from abroad. Transactions are covered by available cross-border transmission capacity and the direction of transactions depends on the prevailing prices in specific areas. This state of affairs periodically results in cheaper energy imports that may lower prices in Poland.

In 2023, Poland’s electricity production was significantly lower than a year earlier in a comparable period. A particularly large difference is observed during the spring months, April to May. In the comparable period, utility power plants recorded a significant decrease in production. Wind sources maintained the previous year’s level of production, while other renewables significantly increased it.

Consumption in 2023 was higher than production. According to data from Polish Power System, electricity production in 2023 amounted to 68,961 GWh, 8.68% less than in 2022. National consumption was lower than a year ago at 70,413 GWh (-4.61% year-on-year). In the period under review, utility power plants recorded an overall decrease in electricity production of as much as 12.67% for the January-May 2022 period. The largest decrease was in lignite thermal power plants (-26.38%). Production at coal-fired power stations was also lower (-11.61%). Gas-fuelled power plants had significantly positive energy production dynamics (25.75%). The largest percentage increase was in other renewable power plants (+41.90%), while wind farms maintained a comparable level of production (+0.16%).

Electricity production in January-May 2023 was lower than national consumption: 68 961 GWh compared to 70 413 GWh (a difference of 1 452 GWh). Coal power plants (32 365 GWh) and lignite power plants (14 664 GWh) accounted for the largest share of electricity production in 2023.

Specification	May			Increasing January to May		
	2022	2023	Dynamics	2022	2023	Dynamics
	[GWh]	[GWh]	[(b-a)/a*100]	[GWh]	[GWh]	[(e-d)/d*100]
			[%]			[%]
	[a]	[b]	[c]	[d]	[e]	[f]
Total production	14 133	**12 704**	-10,11	75 517	68 961	-8,68
Power stations	11 545	9 403	-18,55	62 693	54 749	-12,67
Hydroelectric	229	323	40,56	1 399	1 736	24,12
Thermal	11 316	9 081	-19,75	61 294	53 013	-13,51
coal-fired	6 554	5 588	-14,75	36 618	32 365	-11,61
lignite-fired	3 876	2 638	-31,93	19 917	14 664	-26,38
gas-fired	886	855	-3,49	4 759	5 984	25,75
Other renewable power plants	1 213	1 881	55,12	3 274	4 646	41,9
Wind power plants	1 375	1 419	3,21	9 550	9 566	0,16
Foreign exchange balance	-363	342	-	-1 703	1 453	-
National electricity consumption	13 771	13 046	-5,26	73 814	70 413	-4,61

Fig. 4. Electricity production by source type in January-May 2022/2023.[6]

Currently, on a daily cycle, energy prices are formed based on the principle of ‘merit order’. This concept functions as a classification for determining the order in which power generation sources are

[6] https://www.pse.pl/dane-systemowe/funkcjonowanie-kse/raporty-miesieczne-z-funkcjonowania-kse/raporty-miesieczne

included in the trading market in order to ensure an economically optimal supply of electricity. The ‘merit order’ classification is based on the criteria of lowest final cost, i.e. the cost suffered by the power plant for the last megawatt hour produced. It is therefore autonomous in relation to the fixed costs of the power generation technology. Power plants that consistently produce electricity at very low costs are the first to be connected to the grid according to their position in the ranking list. Power plants with higher final costs are connected afterwards until demand is met. This model is based on the assumption that power plant operators aim to cover their costs for the next megawatt hour produced. Power plants with low final costs can therefore offer a lower price for their electricity and are therefore more likely to be financially supported than power plants with higher final costs.

The ‘merit order’ of offers thus explains how price formation in the electricity market works. In times of energy shortages, the power system is usually capped by the most expensive gas power plants. This means that, with gas prices of around PLN 400 to PLN 800 per MWh (at the end of 2022), the cost of electricity production has also risen sharply, **regardless** of how the cost of energy production is shaped by other technologies. The cost of power generation from gas therefore often determines the energy price for the entire market today. The market price for electricity is dictated by the price of the most expensive unit entering the power system at any given time, which forms the basis of settlement for all types of generation sources involved in meeting energy demand. It is clear from the above analysis that, regardless of the intensity of development of the RES industry in the current conditions of disproportionately high demand, these sources do not yet have a crucial influence on electricity prices. Extensive consultations and research are currently underway to develop a transitional market model that will reduce the uncontrolled increase in the energy cost burdens on the European economy. First of all, energy is supplied by the cheapest power plants.

At present, in Poland these are as follows:

- renewable energy sources (RES);
- units fuelled by lignite and coal;
- lastly – the most expensive in the set – the units that have the highest manufacturing costs at a given time.

The most expensive sources are incorporated into the system depending on the level of current electricity demand and atmospheric conditions, which affect the level of energy production from RES. The higher the energy demand and the lower the RES production, the more expensive units are included in the system balance. This mechanism has a direct impact on the wholesale price. In

accordance with the rules of the whole, European energy market, the price is also shaped by energy from cross-border exchange (imported from outside Poland or sold to other countries).

In practice, the price of energy sold on the stock market is determined by the price offered by the most expensive unit operating in the system at any given time. As a result of this principle under Polish conditions, the energy price is almost always determined by generators from coal or gas power plants.[7] For example, during a sunny and windy day, the energy system relies on energy from the sun and wind, supported as needed by the cheapest conventional power plants, which set the price of energy. But during the evening peak demand hours, increasingly expensive coal and gas power plants are incorporated into the system. The final price mechanism influences the price formation for all electricity sold on the stock market. It does not matter whether it was produced from the cheapest sources, such as RES, or the most expensive, such as coal or gas units. This makes it easier to finance new investments and to reward production efficiency.

During 2022, the situation on the Polish Power Exchange (POLPX) developed as follows: as a consequence of Russia’s aggressive behaviour on the European energy market and the military invasion of Ukraine, the market was destabilised which contributed to radical increases in energy prices also on the Polish Power Exchange. This was influenced primarily by the increasing prices of raw materials and high CO_2 emission allowance prices:

- the price of gas has risen from PLN 80-120/MWh before the 2021/2022 winter season to over PLN 1,200/MWh;
- the price of thermal coal increased from USD 60-100/T in early 2022 to around USD 350/T;
- CO2 emission allowance prices regularly maintain a price of at least EUR 80/T and have even reached record highs of EUR 100/T (approx. EUR 50/T in early 2021 and EUR 24/T in early 2020).

At the same time, the destabilisation of the European market has been further influenced by the low supply of energy produced in the units with the lowest production costs in European countries, which has resulted, among other things, in:

[7] https://pkee.pl/aktualnosci/mechanizmy-ksztaltowania-cen-energii/

- limited production from hydropower plants due to drought-induced poor hydrological conditions;
- shutdown of a significant part of nuclear power plant units in France due to maintenance work – less than half of installed capacity available;
- the shutdown of a significant part of the nuclear power plant units in Germany, linked to the plan to give up nuclear power;
- periodically lower windiness, reducing wind farm production.

1.3. Amending measures – a programme of gradual reforms of the energy market in Poland.

On September 28, 2022, a draft of the amendment to the Act ‘Energy Law and the Act on Renewable Energy Sources’ was submitted to the government, which was signed by the President on November 15, 2022. The legislative initiative is intended to make the functioning of the energy market in Poland more flexible and adjust the mechanisms in place to the macroeconomic environment triggered by rapid geopolitical changes after February 24, 2022. It represents a first step towards the reconstruction of the national electricity trading model, aiming to support the transformation of the national electricity industry and its even deeper integration into the European market. An important aspect of the proposed change is also the introduction of legal mechanisms that significantly reduce the risk of market manipulation. In the next step, the plan is to introduce mechanisms for the acquisition of flexibility services in the distribution network areas (which is a key factor for the adaptation of the NPS functionality to further dynamic development of the RES generation area). A key change in the way of increasing the degree of flexibility of legal solutions in the draft law is the proposed provisions abolishing the so-called exchange obligation, i.e. the obligation to sell generated electricity on an institutionalised market, in this case on a commodity exchange.

As a justification for the adoption of the proposed legal solutions, the project initiator identifies the analysis of changes in the volume of energy supply in the Polish market, which indicates the need for dynamic expansion of generation potential, as an important reason.

“In accordance with Art. 20(3) of the regulation 2019/943 of the European Parliament and the Council of June 5, 2019 on the electricity’s internal market, a member country where problems of resource adequacy have been identified shall develop and publish a plan for the implementation of remedial actions. This plan shall identify regulatory distortions and market failures, consider options for

improvement and provide a list of planned market reforms. The document shows significant changes in the characteristics of the Polish energy market. The volume of gross national electricity production in 2018 was lower compared to the previous year and totalled 165 214 GWh (a decrease of 0.38% compared to 2017). At the same time, gross national electricity consumption amounted to 170,932 GWh, an increase of more than 1.66% compared to 2017. In 2018, the growth rate of national electricity consumption was lower than the growth rate of GDP, which was 5.1%, according to the CSO. In 2018, in the national balance of physical energy flows, the share of imports accounted for 7.7% of total revenue, while the share of exports accounted for 4.5% of electricity outflows. Compared to 2017, these two parameters decreased by 0.3 percentage points and 2.1 percentage points respectively. The structure of electricity generation did not change significantly compared to 2017.”[8]

It should still be borne in mind that the majority of energy production is still dominated by technologies based on the combustion of conventional fuels, i.e. hard coal and lignite. At the same time, the leader of generation in the renewable energy sources (RES) segment remained wind based generation. In 2018, the installed capacity of the National Power System (NPS) was 45,939 MW and the generating capacity was 45,650 MW, an increase of 5.8% and 5.4% respectively compared to 2017. The average annual power demand stood at 23,322.7 MW, with a maximum demand of 26,447.6 MW, an increase of 1.5% and 0.8% respectively compared to 2017. At the same time, there is further dynamic growth in power generation from RES installations. Prospective security will be provided by nuclear power plant projects, but until then it is necessary to remodel and reconstruct the NPS with a significant share of RES and balancing mechanisms that will minimise the effects of seasonality and uncertainty in the RES generation process.

The Polish implementation plan involves a gradual implementation of the electricity market reform, relating to changes in balancing rules, energy off-take and the planned expansion of the grid and interconnections. One of the main objectives of the reform is to further integrate and develop the market by emphasising the importance of consumers and private installations in the energy market and obliging system operators to embrace the flexibility of energy systems (this is a technical necessity that allows the effective expansion of capacity with RES, the growth of which is possible in a shorter transition period than the possibility of building large-scale nuclear power sources). This is accompanied by strong support for the development of distributed generation sources located close to electricity consumers and consequently meeting energy needs within subsystems functionally

[8] https://orka.sejm.gov.pl/Druki9ka.nsf/0/1ECC9BA25F27F689C12588CB0025831D/%24File/2634.pdf

separate from the national electricity system. These circumstances will mean that the paradigm for managing the operation of the national power system will gradually change by significantly complementing the central disposal of generation sources by coordinating the operation of generation and consumption resources integrated in supply-demand balancing. Under this model, wholesale electricity trading will gradually be reduced to selling the excess electricity and covering electricity deficits arising after internal balancing of supply and demand.

The current amendment to the Energy Law introduces a broad catalogue of changes that also directly affect more than a dozen other pieces of legislation. It is a comprehensive catalogue of regulations introducing innovative solutions, the implementation of which significantly helps to continue the transformation process. These changes include:

- the introduction of provisions to allow, from 2026, a technical change of electricity seller within 24 hours,
- enabling access to the electricity comparison tool for household consumers and micro-entrepreneurs with an annual consumption of less than 100 MWh,
- introducing a legal framework for the operation of citizen energy communities,
- introducing the right for customers to enter into contracts with dynamic electricity prices and to receive information on the benefits and risks associated with such contracts,
- introducing a new model for the sale of back-up electricity,
- implementation of a non-market restricted mechanism for RES power generation and the reduction of off-take and grid injection by electricity storage facilities,
- introducing the obligation to use a contract template for the gaseous fuel transmission services;
- introducing provisions to provide a legal basis for electricity and/or gaseous fuel transmission or distribution undertakings to coordinate actions and exchange information in the case of requests for connection to the gas network and the electricity network,
- introducing changes to the functioning of the Central Energy Market Information System,
- changing the direct line regulations,
- reducing the administrative burden on owners of generation sources larger than 2 MW,
- introducing provisions for partnership trading in renewable energy.

The proposed project is a significant step towards creating a consumer-oriented, flexible, fair and transparent energy market in Poland. The proposed solutions aim to increase the consistency between

Polish law and EU law by implementing further requirements for the functioning of the electricity market regulated by Directive 2019/944 and Directive 2018/2001. Admittedly, the proposed project does not ensure full liberalisation of the energy market (e.g. the derogation from the requirement to ensure sellers' freedom to set electricity prices is maintained). However, this form of public intervention meets the criteria indicated in Article 5(4) and (7) of Directive 2019/944 and is motivated by the need to protect vulnerable consumers in the not yet fully developed electricity market in Poland.[9]

The development of the electricity market is one of the priorities of the energy policies. Reality confirms that the market is undergoing a significant transformation due to the construction of a European unified electricity market, increased consumer participation in the market and growing electricity production from RES. Under such conditions, individual decisions of market participants will determine the efficiency of the results obtained. In order to achieve this, adequate regulatory instruments should be guaranteed to provide market participants with the maximum possible freedom to pursue individual business strategies within the competitive mechanisms of the electricity system.

Over the last few years, a number of new entities have emerged that are engaged in the business of generating and trading electricity. Their presence has intensified market mechanisms, having a positive impact on the development of competition. Other regulatory changes are initiating the transition of the national market to a decentralised model, where competition is conducted at multiple levels. Particular attention should be paid to the development of alternative forms of market participation by those who have so far only acted as consumers: energy clusters, energy cooperatives or the intensified development of private installations. Thus, the risk of the appearance of risks is significantly reduced, as the appropriate legal framework for the proper functioning and development of a competitive electricity market in Poland has been ensured. In addition, the implementation of successive pieces of EU legislation is significantly changing the existing market structure in the area of consumer mobilisation, so that consumers also start to play an active role on the supply side. These solutions are being successively introduced and it is therefore no longer necessary to maintain the provisions on such a strong interference in the freedom to conduct business, which is the mandatory obligation to conclude transactions via a commodity exchange. These circumstances make it possible to deviate

[9] Ocena skutków regulacji rządowego projektu ustawy o zmianie ustawy – Prawo energetyczne oraz niektórych innych ustaw (druk 3237 i 3237-A) | Regulatory impact assessment of the government's draft law amending the Energy Law and certain other laws (print 3237 and 3237-A)

from the application of the commodity exchange obligation in the field of electricity, as a regulation in relation to the standard applied on the electricity markets.

In the light of the transformation of the electricity market related to the ongoing energy transition (the pace of which has significantly accelerated due to the geopolitical environment), the continued application of the exchange obligation may be a limiting factor for the efficient operation of energy companies or groups. It could negatively impact opportunities for synergies between different activities of energy companies, limiting the optimisation of the entire supply chain, from generation cost through delivery cost to balancing cost. The optimisation is becoming a necessary condition for gaining a competitive edge in the European energy market, which applies both to companies operating as part of integrated energy groups and those integrating their various activities as part of their own business strategies (expansion of their own power supply by companies using energy-intensive production processes). These objectives are crucial in a period of electricity transition, during which ensuring rational and stable prices for final consumers requires the disposition and development of balanced demand and supply portfolios that support efficient decisions regarding the operation of generation sources, the construction of new sources, the de-commissioning of existing sources (including the idea of maintaining their technical capacity to act as reserve sources), and the development of flexibility on the demand and supply side, and of the distribution network. These are essential activities of key importance during the transition period of transition and the construction of stable, large-scale carbon-free sources. These actions will have a significant innovative impact on the part of both market participants and electricity system operators. Plenty of new forms of electricity market activity can be observed, many of which provide opportunities for alternative supply of energy carriers at prices lower than those available in the offers. The development of renewable energy sources, the progressive increase in energy efficiency and the increasingly widespread use of the above-mentioned self-generation systems ensure that electricity demand can be met at attractively economical prices for final consumers will have to increase, as the number of market factors influencing price levels in the current state of market development will force intensified competition, generating the correct price-forming phenomena.

In this situation, the exchange obligation started to cause significant problems in the area of market liquidity. Implemented as part of the first stage of the reform, the changes were aimed at optimising the costs of electricity sales by energy companies. This will also be possible thanks to the reduction of transaction costs and the costs of security and deposits, whose obligatory maintenance is linked to

exchange trading. This amendment is one way of enabling final consumers to gain access to cheaper deals that producers can offer in bilateral contracts.

After the abolition of the exchange obligation, trading transactions will continue to take place on commodity exchanges, but the use of this form of trading will be decided independently by each market participant according to its own strategy. As a result, all market forms of trading will be available for electricity from sources previously included in the exchange obligation.

In cases where stock exchange trading of electricity is optimal – especially due to the fluidity of this market segment, energy prices or transaction costs (including deposit costs) – it may continue to be the dominant trading segment. Where other forms of electricity trading will better support the market strategies of market participants, especially because of the opportunity to build a balanced supply and demand force, to rationalise the costs of operating production sources over a longer period of time or to trade complex products including additional services together with electricity. With regard to the expected risk of an increase in electricity prices following the removal of the exchange obligation, it should be pointed out that the exchange price of electricity is, in principle, set as the marginal price (‘merit order’), i.e. the highest of the accepted price offers. This means that there are possible offers of electricity sales with a lower price. This creates the potential to sell electricity at individual prices below the marginal price, for example as part of the implementation of long-term market strategies, while maintaining competitive pressure to rationalise the size of the market margin, an increase of which would result in higher electricity prices.

The risks of unjustified increases in electricity prices due to the use of market power or other forms of market manipulation are now effectively contained by mechanisms to counter electricity market abuse. The relevant provisions of the Regulation of the European Parliament and of the Council (EU) on Wholesale Energy Market Integrity and Transparency (REMIT) creates appropriate solutions and gives appropriate powers to individual institutions, authorities and national regulatory authorities. The draft of the first stage of market reform provides an increase in financial and criminal liability for those who manipulate the wholesale energy market, attempt to do so or use inside information on a wholesale energy product. With regard to cross-border electricity exchange, an indirect effect of regulation may be the rationalisation of cross-border exchange volumes, including the rationalisation of imported volumes in terms of additional costs for the supply of electricity to end consumers in the long term. This applies especially to costs resulting from sub-optimal operating profiles of power generation sources and over-planned maintenance as a consequence of accelerated loss of life of

generation sources. The direction of the regulatory changes is the first step in the reconstruction of the national electricity trading model, aimed at supporting the transformation of the domestic electricity industry and its integration into the European market. In the next step, the introduction of mechanisms for acquiring flexibility services in the distribution network areas is planned.

1.4. The European CO_2 Emissions Trading Scheme EU ETS. Necessary evolutionary processes.

Like any tool that regulates market phenomena and changes the paradigms of how societies and economies function, it arouses many extreme emotions because it disrupts the way we function in a previously recognised and tamed ‘comfort zone’. However, the current state of the geopolitical environment demands the implementation of the next steps in the evolution of the system in order to adapt it to the environment and increase its effectiveness in achieving its objectives. The EU ETS has both supporters and opponents. Supporters because it encourages carbon dioxide emission reductions, and opponents because it raises the price of energy produced from fossil fuels. It is to be expected that the ETS reform being introduced will arouse equally extreme reactions. Nevertheless, the system is a tool to stimulate change as part of Europe’s energy transition.

The EU’s CO_2 emissions trading system was introduced in 2005. The tool aims to effectively reduce greenhouse gas emissions by taking into account the cost of CO_2 emissions in the production of energy and industrial products. This means that in countries where industrial sectors, including power generation, are responsible for significant amounts of emissions, the production of energy and other products will be more expensive compared to carbon-free alternatives such as nuclear or RES. The system is a simple tool to encourage the proper allocation of investment resources, which will stimulate the maintenance (or increase) of competitiveness by forcing strategic decisions towards a change in the energy mix. Allowances are split into two groups. From the so-called free pool, allowances are allocated for free, mainly to installations exposed to carbon leakage. The funds raised from the sale of allowances by states are revenue for their budgets. The ETS Directive indicates that at least 50% of revenues from the base pool and 100% from the solidarity pool should go to climate targets. Emitters acquire and redeem CO_2 emission allowances. Allowances are purchased on the market from the available pool. As the ETS is primarily intended to lead to a reduction in CO_2 emissions into the atmosphere, the pool of allowances available on the market is decreasing year by year, in line with the EU’s reduction targets.

On December 18, 2022, Parliament and the European Council reached an agreement, which will result in changes to the ETS. Agreement was reached on the revision of the ETS as part of the three key projects of the Fit for 55 package: the reform of the EU Emissions Trading System (EU ETS) and the creation, linked to the ETS, of the Carbon Boundary Mechanism (CBAM) and the Social Climate Fund (SCF). According to the agreement reached, ETS2 participants will have to reduce their pollution by 62% by the end of the decade. It is also very important that, according to the agreement, all revenues generated by the carbon market will have to be dedicated to climate action. Currently, the scheme covers the area of energy and energy-intensive industries. It was recognised that mechanisms should be introduced and implemented to prevent excessive fluctuations in the price of emission allowances. This is to be done by automatically releasing allowances from the EU reserve. The district heating sector will be able to get additional free allowances, however only under certain conditions and in order to encourage its decarbonisation. The inclusion of the maritime transport sector in the ETS was also established. Vessels over 5,000 tonnes will enter the emissions monitoring system from 2025 and the ETS2 from 2027. The decision on smaller units will be taken in 2026. The pools of free emission allowances for sectors to be subject to a border carbon tax (CBAM) will be progressively reduced. These include the production of cement, aluminium, fertilisers, electricity, hydrogen, iron and steel. The free pools will be reduced from 2026 and will disappear from the system from 2034. In addition, waste incineration plants (Thermal Waste Treatment Installations) are being considered for inclusion in the emissions trading scheme. By the end of 2026, the European Commission is to provide an analysis and recommendations for a solution. From the point of view of the functionality of Thermal Waste Treatment Installations, such a solution, introduced too soon, may reduce the motivation for new investments in this area, and their role in solving landfill problems and reducing groundwater pollution can hardly be overestimated at this stage. Such actions will be appropriate at the stage of approaching the goal of having a stable, majority carbon-free energy mix.

In addition, the buildings and road transport sectors are included in the emissions trading scheme, which are to enter a new, separately functioning emissions trading system. However, if energy prices are ‘exceptionally high’, the start of the system will be delayed until 2028. The new system will cover distributors who supply fuel to buildings, road transport and certain other sectors. Part of the revenue from the allowance auction will be used to support vulnerable households and micro-enterprises.

It should also be mentioned that it was agreed that the so-called ‘ETS2’ should be equipped with an ‘emergency brake’. It will be triggered if natural gas prices rise above €106 per MWh on the TTF reference hub. In this case, the launch of the system will be delayed by one year, until 2028. The

consequences of the adopted solutions reforming the EU ETS for the Polish economy mean that, firstly, coal energy will become less and less competitive against alternatives such as RES. Secondly, the budget will have many billions of PLN available each year for the energy transition. One of the most important changes in the system is that countries will be obliged to spend 100% of ETS revenues on climate goals. Until now, it was at least 50%.

1.5. Poland’s position and contribution in the Reformed EU ETS resolutions.

It is an indisputable fact that the reform of the system was necessary to align the EU ETS with the climate targets set by EU law, including a 55% reduction in greenhouse gas emissions by 2030 and EU climate neutrality in 2050. At the same time, in its new form, it includes aspects taking into account the current situation of the global environment with attention to energy security issues. The Polish representation in the European Parliament requested improvements to many of the solutions proposed by the European Commission and the objective was achieved in the form of a reduction in the costs of achieving the objectives set by the European Green Deal for both businesses and citizens. The strategic objective, at every stage of the programme, should be energy security and the elimination of emissions (as a direct function of security), rather than providing jobs. Attention needs to be paid to solutions that effectively link climate protection with economic development, increasing the competitiveness of industries and companies, and an appropriate (including fair) transition. In this context, the increased funding for the Modernisation Fund is particularly important.

Key solutions arising from Poland’s position included:

- a solution was adopted to remove financial institutions from the ETS market, with the aim of reducing the possibility of speculation negatively affecting allowance prices;
- spreading the effect of recalculating the allowances released into the market over two years to prevent a supply shock and a price spike in the ETS market;
- adopting more realistic rules for the calculation of the free allocation for a number of industries – including steel, cement or fertiliser;
- limiting the introduction of the ETS (so-called ETS2) to the transport and buildings sectors to commercial entities only. A separate legislative proposal will be necessary to include households and private transport in the system, submitted by the European Commission no earlier than 2028;

- delaying the implementation of ETS2 by one year (starting in 2027), while accelerating the Social Climate Fund to mitigate the impacts of the transition on the most vulnerable households and transport users and to tackle fuel poverty;
- Adopting a trajectory away from the free allocation of allowances to CBAM industries in a way that allows the operation of the new system to be assessed and gives companies more time to adapt to the new arrangements.

The European Commission's proposed increase of 2.5% between 2025 and 2030 in the Modernisation Fund, of which Poland will be the main beneficiary, has also been preserved. The principle of geographical balance has also been adopted in the distribution of funds from the Innovation Fund, from which companies in our region have so far had a significantly lower percentage of grants awarded than companies from the western part of the EU. It is extremely important to adopt anti-speculation assumptions (in line with the proposed amendment to the Energy Law and Renewable Energy Sources Act of November 15, 2022). It has been repeatedly stressed that the ETS should be limited to only those parties that need allowances in order to carry out their activities. It is all about energy companies, district heating companies and energy intensive industries – financial institutions must be excluded from the system. In order for the ETS to function according to its spirit, it must be immune to any attempt to speculate it.

The Carbon Boundary Adjustment Mechanism (CBAM) is to establish a charge on certain imported products to reflect the cost of CO_2 emissions for European producers. The aim of adopting this new mechanism is to equalise the rules and thus the competitiveness of European and imported products. Among the solutions adopted by Parliament were the centralisation of the system and the strengthening of measures to prevent circumvention and thus unfair competition.
The aim of the creation of a social climate fund is to safeguard citizens who are most vulnerable to the negative effects of the energy transition associated with rising electricity or heat prices. The fund will, for example, be able to finance the thermal modernisation of buildings or the installation of heat pumps, thereby reducing the bills paid by Europeans. The creation of the Fund is crucial to the successful implementation of the transition. Alongside the Just Transition Fund, it is another mechanism to assist citizens who may be affected by the transition – this time through increases in energy or heat prices. It is crucial that the fund is up and running as soon as possible so that those most in need can receive support before the climate law changes come into force.

1.6. REPowerEU – a programme of lessons learned from the events of February 24, 2022.

In the immediate aftermath of the Russian military invasion of Ukraine, the European Union was forced to revise its position on the sourcing of energy resources. While previous business-as-usual policy measures were strongly contested by EU countries originating from the former Eastern Bloc, this policy was implemented in an unwavering manner. The military invasion has initiated a process of change that will profoundly alter the energy policy of the European Union. At the same time, the REPowerEU programme confirms the ability of EU structures to formulate conclusions (albeit post facto) and to change approaches. Each passing day of Ukrainian resistance reinforces the belief that there is no going back to the way things were before February 24, 2022. The declared goal of the European Green Deal was to transform the Union into a just and prosperous society living in a modern, resource-efficient and competitive economy that achieves zero net greenhouse gas emissions in 2050 and where economic growth is separated from the use of natural resources. The aggressive Russian invasion of Ukraine has changed the picture dramatically. As of February 24, the need for energy transition is not only driven by the need to protect the climate, but mainly by the need to become independent from the authoritarian regime in Russia. It is astonishing that EU policy (in particular inspired by the German government) has failed to recognise that it has an unpredictable partner on the other side of the gas pipelines, which has shown a tendency over the years to blackmail its customers with the threat of ‘turning off the tap’. Russia’s behaviour towards the gas storage facilities under its control in Western Europe, aimed at softening the response of EU states to its planned aggression, has clearly demonstrated the failure of a policy based on taming Russia by including it in the mechanisms of the European energy market. On March 8, the European Commission already adopted the REPowerEU plan, which envisages:

- joint European action towards secure, sustainable and affordable energy, aiming to reduce energy dependence on Russia,
- speeding up the “panelectrification” of Europe, including accelerating the development of energy generation from RES and the use of heat pumps,
- the urgent diversification of Europe’s natural gas supply, notably through increased use of LNG,
- accelerating the electrification of industry and increasing the rate of substitution of natural gas with hydrogen.

It is worth noting that in March, the International Energy Agency published a 10-point plan to reduce oil demand. It primarily includes a change in citizens’ transport behaviour – including, among other

things, a reduction in maximum speed, the spread of home office, a reduction in business travel in favour of teleconferencing and the promotion of urban micro mobility. Unfortunately, over the period 2014 –2022, the European Union missed the opportunity to comprehensively prepare itself to properly manage the risk of having an unpredictable fossil fuel supplier partner in the form of the Russian Federation.

The voices of the former Eastern Bloc countries – led by Poland, on whose initiative a policy of energy solidarity was admittedly devised – were not properly taken into account. Germany’s policy in particular, which has made Europe significantly dependent on fuel supplies from Russia, has been brutally verified and it must realistically be said to have been instrumental in exacerbating the effects of the current crisis. In view of the current situation, the need to adapt actions to the near-crisis geopolitical situation has been identified, together with a with a redefinition of the strategic objective of the transformation. Redefinition does not mean a change in the expected end result; in this case, the strategic objective is expanded to include the overarching goal of energy security.

Since the beginning of the Russian invasion, electricity consumption in Ukraine has declined sharply. Can Poland, which is struggling with a highly carbon-intensive economy and insufficient generation capacity, somehow cooperate with its eastern neighbour to improve the economic and energy situation on both sides? This question could be considered in April/May 2022. At the moment, it must be assumed that a full-scale military war across Poland’s eastern border will be long-lasting and any estimate of when it will end is equally unauthorised. The Polish power generation sector is still largely based on coal fuel. This makes the implementation of the emissions reduction plan a significant challenge for our country. Although the capacity of installed renewable energy sources in the Polish energy mix has been growing dynamically in recent years, unfortunately it is still coal that dominates the production. In 2021, more than 75% of electricity was generated from coal, despite the installed capacity of coal units being a record low 58.5%. and this result is weaker than in 2020, when coal-fired generation was less than three-quarters. An even worse result than last year's average was recorded in March 2022, when electricity produced from RES amounted to only 16.1% of total production. This situation clearly demonstrates the need for a stable alternative to the current structure of the energy mix, which does not meet previously assumed levels and hinders the implementation of the PEP2040 plan. The fuel to help reduce emissions and stabilise RES was to be natural gas and liquefied petroleum gas. As in Germany, it was to be a temporary solution, used until sufficient capacity to produce electricity from environmentally friendly sources was achieved; including nuclear power, wind and solar farms and the development of energy storage methods. However, the winter period has shown

how unstable the gas fuel is from a cost, speculative and political point of view, which is particularly evident from the several price increases on the SPOT markets. As a result, voices calling for a shift away from Russian gas have become more and more audible.

After the Russian invasion of Ukraine, the prices of energy raw materials skyrocketed and almost the entire Western world declared a gradual shift away from Russian raw materials in order not to support the aggressor. The Polish government, which announced a shift away from Russian coal and oil, behaved no differently. The pressure from EU officials regarding sharp dates for the elimination of coal from the energy mix has also decreased. This is due to the pressing need to find alternative suppliers of gas and oil. Declarations by EU countries show a likely trend for the coming years of cutting Russia off from its most significant influence. However, in the energy sector, Russian raw materials are difficult to eliminate entirely in the short term. In addition, there is a real threat of supply disruption from the east, which requires a revision of energy plans to prevent an even bigger crisis.

As a result, Belgium has halted the closure of its nuclear reactors generating around 40% of the country’s energy by 10 years, and Germany has included the construction of LNG ports and an even stronger increase in the share of RES in its strategy, reaching 80% as early as 2030. Another option that could be considered in the event of an extreme shortage of natural gas supply is to turn to coal, which, despite the high cost of the EU ETS with the projected possible price increase, is a very competitive option given the cost of power generation and the possibility of a much easier diversification of supply compared to gas. However, burning more coal will not help to meet climate targets or, paradoxically, contribute to security. To give an example, in March 2022 as much as 84% of Poland’s electricity was generated from fossil fuels, including almost 76% from coal! So what are the options? One simple method is to reduce consumption. However, it is only simple in theory, because every consumer wants to satisfy his or her electricity needs. Poland’s ‘roadmap’ to carbon neutrality involves the construction of large-scale nuclear power.

1.7. Lobbying in the European Union.

In principle, the EU lobbying system is no different from most national lobbying. Most lobbying activities are carried out discreetly and over the long term. As long as the correct rules for these activities are followed, there is nothing wrong with them. It is important to remember that they are often a source of innovation and publicly available added value. According to the Oxford report on lobbying, each major EU institution has developed specific formal and informal institutional access

criteria over time to create greater EU public policy, building the value of lobbying on trust and credibility as the strongest currency in Brussels.[10]

In the case of the European Commission, the mentioned report identifies three functions that affect the style of lobbying in different ways: legislative, executive and custodial. In legislative terms, the Commission is an agenda-setting body with the formal right to initiate and develop legislative proposals.

The current regulatory framework in the European Union defines lobbying as “any activity (...) carried out with the objective of directly or indirectly influencing the policy formulation or implementation and decision-making processes of the EU institutions, wherever they are located. These activities are undertaken through a channel or means of communication, for example through outsourcing, media, contracts with professional intermediaries, think tanks, platforms, forums, campaigns or grass-roots initiatives.” Lobbying in this case refers to organised activities carried out with commitment by professional public affairs practitioners, who are generally referred to as lobbyists. It is a complex field and, for those who practise it, often requires a sound knowledge of politics, business, communications and law. At its core, it requires a transparent and ethical framework.

The institutional landscape of the European Union in Brussels, where 28 member countries are represented, makes it a global destination for lobbyists. Policies adopted by the EU spread across EU member countries and around the world make the EU a major hub for lobbying activity. Democracy is a multi-layered system in which various social, political and economic actors seek to play a role in policy-making. The globalisation and internationalisation of legislative and regulatory issues often means that lobbyists need to focus their efforts on influencing decision-makers at all relevant levels. We currently have 12 954 registered lobbying organisations in the European Union. These mainly include more than 6,000 NGOs, more than 3,000 professional consultancies and around 1,000 think tanks, research and academic institutions. Comparing these figures to 2019, we see a consistent increase in lobbying organisations operating in the European Union. Public concern about the impact of lobbying remains high among citizens across the European Union. Seven out of ten citizens (70%) agree that it is common knowledge that lobbyists exert a strong influence on EU policy-making. Although lobbying is a legitimate form of interest representation, public confidence in the decisions taken by the European Union can be damaged if citizens perceive that their voices are counterbalanced

[10] ibid

by the target group pressure of particular interest groups. 31% of survey participants completely agreed on the strong influence of lobbyists and were of the opinion that the EU should take appropriate measures to ensure that the public is fully informed about the actors involved in decision-making and the drafting of legislation.[11]

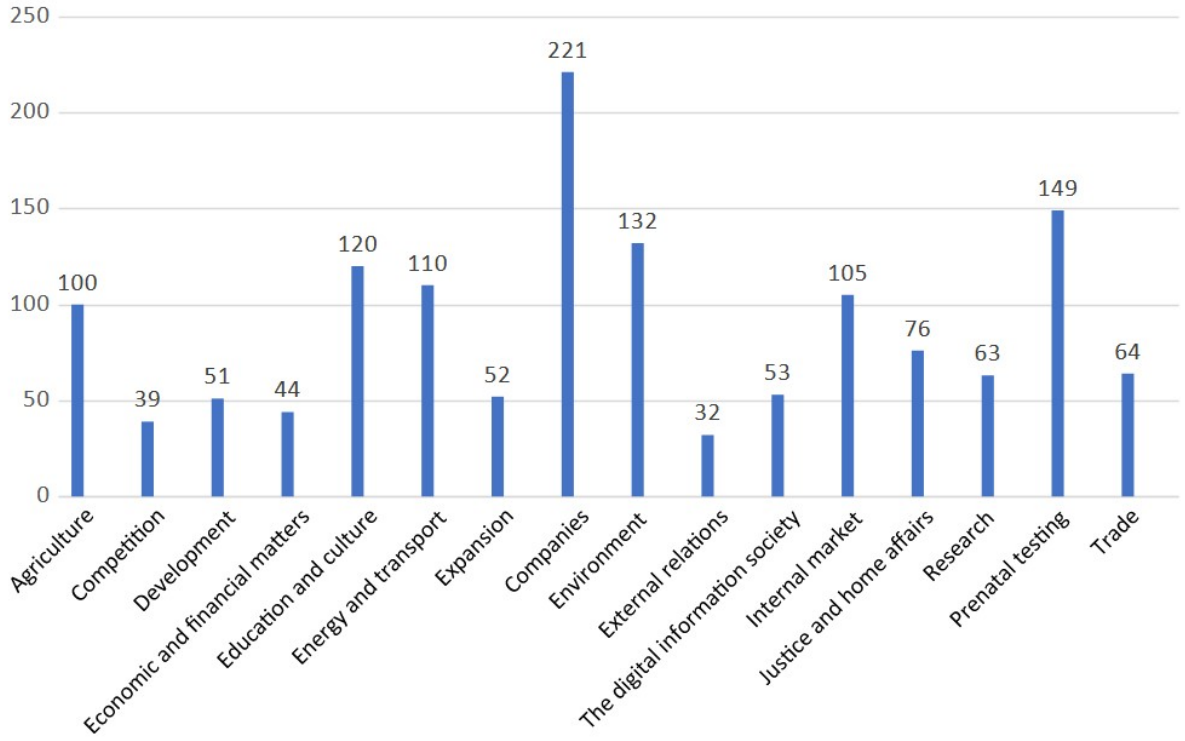

Fig. 5. Number of interest groups active in the various EU directorates-general.

Before the outbreak of war in Ukraine but already during the Russia-Ukraine conflict, the energy sector was the most influential voice of the corporate community in Europe. It was an example of the convergence of business interests with the political and security objectives of many European countries. The tactics of energy pressure groups show how the Russian lobbying mechanism in the EU worked. It could be divided into three areas:

a) the employment of lobbying firms,

b) influencing decision-makers and leaders in European countries and EU institutions,

[11]“EU CITIZENS OPINION POLL ON TRANSPARENCY, ETHICS, AND LOBBYING IN THE EU” https://www.access-info.org/wp-content/uploads/Infographics_EU_citizens_Opinion_Poll_ENGLISH_ONLINE.pdf

c) interaction within organisations representing business interests – chambers of commerce, industry associations, trade unions, etc.

Directly influencing decision-makers and leaders may be the most difficult (but also the most effective) way to achieve the ultimate goals. Currently, only the European Commission and the European Parliament have a voluntary register of representatives' interests ('Transparency Register'), which is linked to rules of conduct for lobbyists. This register does not include the EU Council or other EU bodies and agencies. Civil society and members of the European Parliament have expressed a negative opinion of the current system for its failure to control and maintain the transparency of lobbyists in Europe; this research shows that there would not be broad public support for mandatory regulation of lobbyists. It should also be taken into account that the vast majority of countries have no regulation of lobbying in general and no structured process for recording contacts between lobbyists and decision-making stakeholders.

Europe falls behind the United States and Canada in this respect. Of the 19 countries examined in the Transparency International report, only seven had laws or regulations specifically regulating lobbying (Austria, France, Ireland, Lithuania, Poland, Slovenia and the UK). The research also shows that some of the laws and regulations that are in place in Europe are, to varying extents, flawed or unsuitable for clear compliance. Consequently, there are serious problems with their implementation and enforcement.

Lobbying by business representatives may result in political behaviour that may conflict with the public interest. There is a general perception among EU citizens that the public interest and business interests do not always coincide. Almost four in five (77%) citizens agree that lobbying by business representatives can influence politicians, who may not represent the public interest in their actions. Unregulated lobbying or unequal access to EU decision-makers can increase the risk of dubious interests dominating decision-making processes or favouring certain interest groups. If citizens perceive lobbying by companies that negatively influences decision-making and results in unfavourable legislation or influences EU politicians who act contrary to the public good, they may start to lose trust in the political and official structures of the European Union. Thus, EU Officials should particularly ensure that the public interest is at the forefront of the policy-making process; including by actively seeking the involvement of a wider range of citizens and other interest groups who are not already lobbying proactively.

Up-to-date and relevant information on the various stages of the decision-making process should be made available proactively in advance, so that engaged citizens and civil society can determine when and how to participate. Citizen participation should start at an early stage and public consultation should take place at regular intervals throughout the decision-making process.

The EU should strive to create a more equal participation environment in legislative processes and other decision-making by ensuring the fair involvement of interest representatives, citizens and other stakeholders. EU officials should commit to publicly register all meetings with interest representatives, including details of the issues discussed, especially when they relate to the ongoing decision-making process. EU authorities should proactively publish information about the parties involved in the entire decision-making process, as well as publish all positions, opinions and other documents submitted to them by external interests, whether they are part of a formal consultation or not.

Chapter 2:

The awareness of current challenges as a key factor in the proper planning, conduct and management of risks of the transformation of the National Power System.

2.1. Introduction.

The current geopolitical environment, although extremely unfavourable, will paradoxically enable the development of strategies for energy transition and sovereignty, taking into account the factors present in the most pessimistic forecasts. It revealed higher-level priorities, such as the need to seek and absolutely exploit the close synergy of Poland’s energy policy with all aspects of the functioning of the state body. In addition, it will enforce the development of plans to achieve objectives in a flexible manner, allowing for ongoing adjustments to tactical and operational action plans – medium and short term, depending on changing environmental conditions. The main objective remains the same: security, energy independence and the climate target.

In order to properly define a flexible strategy and action plan, it is necessary to set immutable paradigms for the functioning of the state that will serve as a reference point. The chain of functioning of the state's economic structure can be considered as such a reference point:

- obtaining raw materials,
- production of goods (including energy),
- added value (own innovations, creative developments),
- profits to enable further increases in value,
- security.

Security should be understood as the capacity and ability to manage risks without defensive action. The order of the above economic structure diagram’s items does not reflect the degree of importance of the individual items. Instead, security located at the end of the list is the foundation of the entire value chain.

As a medium-sized country in Central and Eastern Europe, Poland has a National Power System that is relatively poorly adapted to geopolitical realities. The actual state of affairs reflects the lack of consistent long-term strategies over the last 30 years, the absence of an action plan, short-term activities undertaken without taking forecast scenarios for changes in the geopolitical environment

into account and, above all, strategic decisions taken under the influence of public pressure that was not substantively justified and which resulted in political decisions (abandonment of the Żarnowiec NPP). In this situation, the implementation projects for the LNG transhipment and regasification terminal in Świnoujście and the ‘Baltic Pipe’ gas pipeline, commissioned on October 1, 2022, appear to be positive aspects. The current structure of the fuel mix of the Polish energy sector (Fig. 6.) forces our country (until February 24, 2022) to maintain natural gas as a transitional fuel, which means that from 2022, Poland is condemned to the only available route for the supply of this fuel: **sea imports**. This state of affairs raises specific implications in terms of the need for well-considered management of locally available fossil fuels (coal and lignite), well-considered and structured development of RES energy sources in the medium and long term, together with the acceleration of work on new energy storage technologies and, above all, the coordination of appropriate synergies between the energy and defence industries. A key task will be to maintain the security of the offshore supply of gaseous fuel (both in terms of the security and integrity of the infrastructure and the ability to operationally observe threats and identify potential risks).

2.2. Current state of the National Power System.

The current situation requires Poland to take the long-awaited path of a proper energy transition and the creation of a new economic order which will focus on the best possible synergy between all areas of politics, economy and defence. In order to do this, however, it is necessary to re-evaluate the current objectives, set a common strategic goal for these areas and implement a system of state administration culture that makes management processes immune to possible and temporary attempts at ‘manual control’.

According to the energy strategy, the Polish power industry was to gradually move away from fossil energy sources (with natural gas as a transitional fuel) to consistently replace them with zero-emission equivalents. Therefore, onshore wind farm projects had been underway for some time (until May 2016 when the Distance Law, commonly referred to as ‘Law 10h’, came into force), then the investment market for photovoltaics was freed up for both micro-installations and large capacities (during this time, wind farm projects in progress continued), and investments in gas energy sources were planned. In March 2023, an amendment to the Distance Law was adopted, which liberalised the distance of wind farm installations from built-up areas from the original ten times the height of the mast and turbine to a measurable 700m. As a next step, in April 2023, the Council of Ministers adopted a project for an amendment to the Law on Renewable Energy Sources and Certain Other Laws, which was

submitted for first reading in committees on May 24. The deadline for the submission of the committee report is July 5, 2023. Over the last 12 months, the intensity of legislative work has been significantly noticeable. These activities are intended to ensure the energy stability of the NPS until the first and further (in 1–2 year periods) NPP units are planned to be commissioned in 2033. It should be noted that not all relevant tools have been properly used. At the forefront in this context is the manually controlled allocation of funds collected under the European EU ETS. These funds should be allocated entirely to the energy transition.

Otherwise, it is only possible to temporarily, artificially maintain relatively low electricity prices, but in the long term this will mean “frittering away” the funds whose role was to stimulate investment towards a proper transformation of the NPS.

Another unexploited potential is the stagnation of investment in the modernisation of Polish transmission and distribution networks. As a result of such forecasts, Poland is more exposed to network failures related to overloads and disruptions resulting, for example, from weather phenomena. In this context, the de-concentration of energy sources in the form of, among other things, photovoltaics, may be equally effective not only in increasing the share of RES in the Polish mix, but, unfortunately, in creating transmission problems related to the limited possibility of forecasting the share of these installations in balancing energy demand.[12]

As a point of comparison, we can compare the energy mix data of countries with significantly different energy production structures.[13] The structure of the energy mix of the three different systems – Poland, France and Germany – until April 15, 2023 (the date on which the Emsland, Isar 2 and Neckarwestheim power stations were disconnected from the system) was as follows (as at the end of Q1 2022). For the time being, this part of the German mix is being smoothly replaced by lignite-fired generating units, RES sources depending on availability and energy imports from France and Poland.

[12] *biznesalert.pl, Michał Bielicki: “Analiza miksu energetycznego dla Polski”*
[13] Source: GUS, National Institute of Statistics and Economic Studies (INSEE), Federal Statistical Office (Destatis)

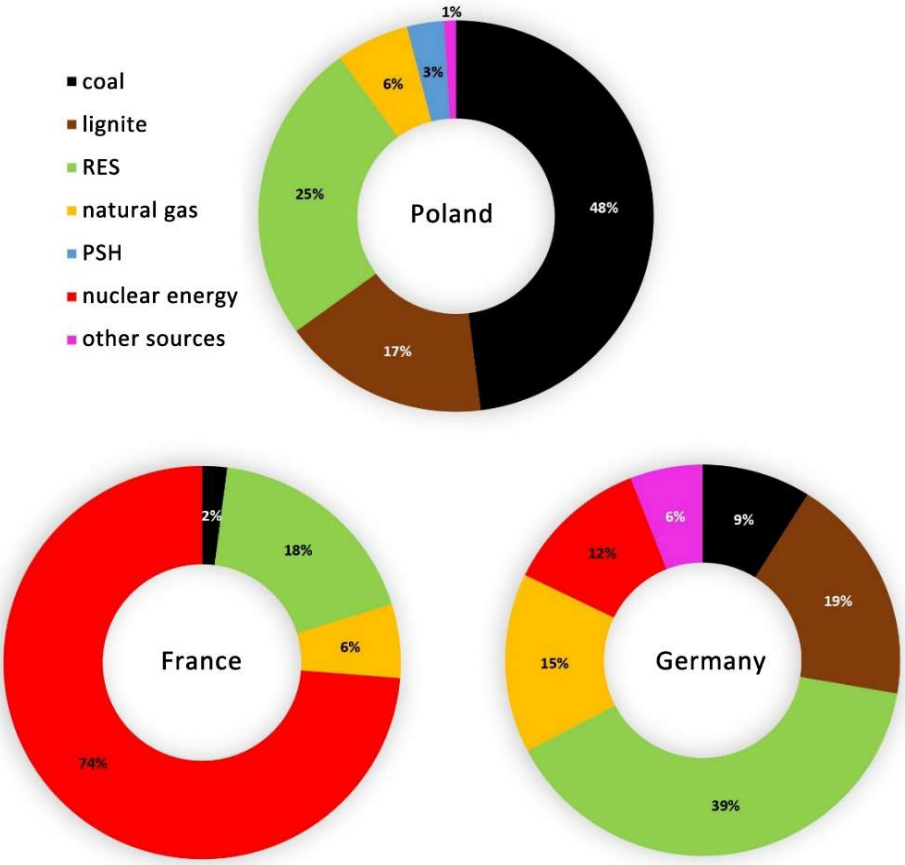

Fig. 6. Share of individual energy sources in the Polish, German and French energy mix at the end of 2021.

The German energy mix structure indicated the need to replace the current share of coal (19% + 9% = 28%) and gas (15%) with NPP sources, which would consequently increase the share of nuclear power to 55%. Such a course of action would help to ensure the stability of the system’s operation and could be implemented relatively quickly. A significant share of RES sources (especially large-scale sources operating under stable conditions like offshore wind farms) would allow the technology to maintain its pace of development and, while remaining emission-free, could play the role of balancing sources (the development and widespread use of energy storage technologies will significantly increase the utility of this area of generation – but this is a prospective measure).

There are many indications that Germany is including the dynamic development of hydrogen technology in its strategy. Germany’s “National Hydrogen Strategy”, adopted in June 2020, sets a 2030 target of installing electrolysers with a capacity of 5GW (the EC target for the entire EU is 6GW) to produce 14TWh of green hydrogen energy, providing 15% of the hydrogen consumed in Germany. With political support, German industry is to become a leading international supplier of hydrogen technology. The strategy includes a programme of action with which market growth and the

foundations for a functioning hydrogen market in Germany are to be initiated. CO_2-neutral “blue” hydrogen will be used mainly in industry and transport with state aid in excess of €10 billion. There is talk of exempting any electricity used to produce green hydrogen from the levy. There is growing evidence that increased use of hydrogen from renewable or non-CO_2 emitting sources is necessary for increased climate protection efforts. The National Hydrogen Strategy aims to establish a framework for the production and use of hydrogen in Germany. Industry, network operators as well as science and research are in agreement: CO_2-free hydrogen is essential to achieve the ambitious decarbonisation targets for Germany by the middle of this century.

Another important aspect of the fuel crisis is the fact (which cannot remain without proper comment) that all hydrocarbon substances (oil, coal and natural gas), in addition to their role as energy carriers, are also used in the economy as raw materials for the production of key goods. Petroleum is a raw material for the production of transport fuels, components for plastics, paints and varnishes, asphalt intermediates and much more. Coal is used to produce coke, which is used in the production of steel in the steel industry, and natural gas is the primary raw material for the production of synthesis gas in the fertiliser production process. The share of these fossil fuels as raw materials and intermediates in industry is so significant that their shortage in the area of energy generation is not the only factor exposing the national economy to crisis phenomena. Furthermore, their role as production raw materials is fully independent of the development, or lack thereof, of RES and other carbon-free generation sources. In view of the above, the development of RES is a relevant and important factor in supporting the mitigation of the fuel crisis. Unfortunately, they are not a so-called ‘panacea’, a remedy, for all disruptions resulting from the need to gradually move away from their use as exclusive energy carriers – hence the need to build a synergistic NPS with a substantial capacity to provide security, stability and climate targets automatically and as reliably as possible.

2.3. Transmission and distribution infrastructure.

The above mentioned historical circumstances and the current sudden turn in the geopolitical environment have resulted in a dangerous state of accumulation of challenges that the NPS and its Operators will have to face over a period of several years. Any action in a particular area is not without impact on other areas. The energy transition, which was originally the result of intentions to limit the impact on climate change, has been accelerated by a sudden energy crisis rooted in a dynamically changing geopolitical situation. So far, the developments in the operation of the NPS have not been fully coordinated as systemic measures. The current necessity is to articulate all challenges,

systematise actions and add medium and short term action plans to the complementary National Power System development strategy. While the necessary development measures for re-modelling the generation mix towards zero-emission sources (including offshore wind farms and balancing support sources) are known, the necessary measures for adapting the transmission and distribution network are still unarticulated.

The generation sources will ultimately be more evenly dispersed compared to the current layout and the share of supporting and balancing source capacity will increase significantly in relation to the total installed capacity. That is why it is so important to ensure, to the greatest extent possible, synergies between the operation of system sources and those supporting the balancing of electricity supply and demand. From the point of view of the stability of electricity system operation, a key factor is to ensure that system performance can be planned over different time horizons. As a result, significant challenges lie on the electricity transmission and distribution side. In particular, as the share of RES energy in the energy mix increases significantly, a plan for the construction of large-, medium- and small-scale energy storage facilities (pumped storage, gravitational energy storage, hydrogen production facilities, etc.) is necessary to ensure proper balancing. This issue must be taken into account throughout the distribution area down to the micro-installation level. Decisive measures have been taken in this aspect and the first important one is the decision to reinstate the suspended programme for the construction of the 750 MW “Młoty” pumped hydroelectric energy storage, located in Kotlina Kłodzka. Energy storage is defined as “the conversion of electricity taken from the electricity grid or generated by a generating unit connected to and interacting with the electricity grid into another form of energy, the storage of that energy and its subsequent conversion back into electricity and injection into the electricity grid.” The very definition indicates that the role of energy storage is to reduce the impact of instability in RES generation. Until now, the NPS has not had such an extensive network of energy storage facilities due to the presence of, among other things, flexible, gas-based generation sources in the system (energy storage facilities in the form of hydroelectric or pumped hydroelectric energy storage have always cooperated with the NPS). Incorporating energy storage on a scale that will meet the needs of the NPS with the planned share of RES in the mix makes them almost a separate, new area of the electricity system.

In the area of energy transmission (extra-high voltage networks – EHV), there are implemented (although insufficiently) and planned investments for replacement, modernisation and development, aimed at increasing the density of network connections in the central and northern parts of the country. With regard to energy distribution (high, medium and low voltage networks – HV, MV and

LV), the amount of investment required is a major challenge due to the density of the network and the fact that the amount of distributed energy sources generated on the low and medium voltage side (RES sources and micro-installations) is increasing rapidly. From the point of view of the stability of network operation, these are parasitic sources (this term should not be taken as a pejorative but only reflecting the nature of the operation and the impact on the stability parameter). In recent years, due to external factors (the SARS-CoV-2 pandemic) and political factors (the need for the Distribution Companies to take over coal mining assets), the pace of development, modernisation and restoration of the distribution network has slowed down significantly.

In terms of distribution infrastructure, the number of investment tasks that need to be carried out is summarised in the table below showing a comparison of the age structure of selected elements of the DSO network between 2017 and 2020:

Infrastructure component	< 10 years		10 – 25 years		25 – 40 years		> 40 years		Growth
	2017	2020	2017	2020	2017	2020	2017	2020	> 40 years
HV overhead lines	9%	12%	15%	11%	34%	31%	42%	46%	4%
HV cable lines	80%	70%	17%	22%	3%	7%	0%	1%	1%
HV/MV stations	17%	18%	20%	18%	33%	29%	30%	35%	5%
HV/MV transformers	29%	36%	19%	17%	33%	28%	19%	19%	0%
MV overhead lines	7%	7%	17%	14%	39%	31%	37%	48%	11%
MV cable lines	31%	35%	28%	27%	24%	21%	16%	17%	1%
MV/MV stations	nd	57%	nd	23%	nd	6%	nd	13%	nd
MV/MV transformers	nd	23%	nd	20%	nd	15%	nd	42%	nd
MV/LV stations	19%	19%	22%	19%	32%	29%	28%	33%	5%
MV/LV transformers	31%	29%	25%	26%	29%	27%	15%	19%	4%
LV overhead lines	13%	14%	21%	21%	35%	31%	31%	34%	3%
LV cable lines	31%	31%	31%	31%	25%	23%	13%	15%	2%

Tab. 1. Age structure of electricity distribution infrastructure in the period 2017 – 2020.

The following conclusions can be drawn from the above data:

- as much as 46% of HV overhead lines (110kV – initial distribution) are over 40 years old;
- 70% of HV cable lines are less than 10 years old, however, it should be borne in mind that the quantitative share of HV cable lines in relation to overhead lines is disproportionately lower (mainly in urban areas);

- 35% of HV/MV stations are over 40 years old, while together with facilities in the 25-40 year age range, they account for as much as 64% of the number of total stations;
- 48% of MV overhead lines are over 40 years old and together with the 25-40 year age range they account for 79% of total overhead lines;
- 36% of MV cable lines are less than 10 years old and together with the age range of 10-25 years they account for 62% of the total lines of this type;
- MV/MV distribution stations (network distribution points) – 57% are less than 10 years old, which is a consequence of the high rate of development and modernisation of the MV distribution network (especially in the industrial area);
- 42% of MV/MV transformers are over 40 years old and together with the age range of 25-40 years they account for 57% of the total quantity, which is not a critical factor, as the transformer is a long-lived piece of equipment if the correct operation and service regime is maintained;
- secondary distribution MV/LV transformer stations with a combined age range of 25-40 years and over 40 years represent 62% of the total stations;
- 34% of the overhead LV lines are more than 40 years old and together with the 25-40 year age range they account for 65% of the total lines of this type;
- LV cable lines are the relatively the youngest part of the network infrastructure and, in the ranges of 10-25 years and less than 10 years, account for 62% of lines of this type overall.

In order to objectively assess the modernisation activities of the DSO Companies, it is important to note that investments in network infrastructure to date have been made in the right directions. Particularly in the area of secondary energy distribution, emphasis has been placed on the cabling of LV lines, the replacement of MV/LV transformers and increasing the proportion of MV cable lines. Relatively strong emphasis was also placed on replacing and upgrading HV/MV power transformers (the effect of increased power demand on the primary distribution side) and adding FDIR (Fault Detection Isolation and Restitution) components to the MV network infrastructure. A critical factor in the current situation of the National Energy System in the clash over the need for transformation is that all areas of it – from generation to secondary distribution – need to be modernised and adapted to change at the same time. This is an extremely ambitious logistical and managerial challenge. The NPS restructuring plan should be implemented on the basis of a coherent strategy and well thought-out tactical and operational action plans (including necessary legislative changes). We should not leave the process to chance, not even in the slightest. The maximum possible use of the national potential of the executive and production entities in the restructuring process of the NPS is also an extremely

important aspect. In parts of the network infrastructure, this potential can be realised almost entirely. All specialists meet the highest standards and have years of experience and modern equipment. The direction set out above was confirmed by the initiative taken by the Energy Regulatory Office, the ERO, and on its initiative the “Charter for the Efficient Transformation of Polish Power Distribution Networks” was signed on November 7, 2022. The document signed by the ERO President and representatives of the five largest Distribution System Operators is the first stage of sectoral cooperation in the energy distribution area. In the next steps, a new DSO regulatory model will be developed and investment targets will be set and legislative changes will be initiated to enable implementation and provide support to the DSO market.

The necessary support from the state should first and foremost ensure that domestic entrepreneurs can plan ahead. It is extremely difficult to operate in a business where there is uncertainty about the formal and legal environment in even the medium term. The national delivery capability needs relatively few key facilities to operate effectively:

- stabilisation of the formal and legal environment over a minimum of five years (ideally ten years).
- clear and comprehensible contract terms;
- to relieve the burden of acquiring land rights by the contractor at the stage of designing the investment task and, consequently, in a situation of higher necessity, to implement the Strategic Infrastructure Act (known as the Transmission Act), the draft amendment of which was sent to the Parliament on April 25 this year; on July 11, 2023, the bill was submitted to the President of the Republic of Poland and is awaiting his signature.

2.4. National Energy System challenges in the near future.

Any strategy, in order to be implemented effectively, should be complemented by a tactical action plan (implementation plan) in relation to the business environment. Polish companies are able to develop methods of implementing the latest technologies on their own, obtain funding for development and the necessary equipment. Unfortunately, operating in an environment of unstable legislation – established to meet current needs or under the influence of (often legitimate) public pressure – it is impossible to plan for risk management. Business development requires the ability to take these risks, but with the necessary awareness of the ability to manage them.

Poland’s EU commitments on RES energy and technological advances linked to falling installation costs have contributed to the dynamic development of this area. The development of distributed generation is contributing to a gradual change in the role of the distribution network – from a passive network to an active network. To date, the operation of the NPS has largely relied on the one-way flow of power from large centrally dispatched generating units connected to the transmission network, through the high-, medium- and low-voltage networks, to final consumers. The current centralised market model will not, in future, be able to stimulate flexible operation of the NPS. The increasing variability and unpredictability of the power balance components will force a change in the way the system is planned to develop and run from deterministic to probabilistic. The transition to a more flexible model requires a new approach to ensure the security and reliability of energy supply.[14] The main network constraints present in the NPS arise from:

- the underdeveloped transmission network in the northern part of the country;
- uneven location structure of generation sources (most generation units are located in the south of the country);
- unplanned flows on cross-border interconnections; network congestion affects the operation of generating units.

Some constraints are permanent, forcing generators to operate in ‘must run’ mode. The others are decommissioned by changing the network topology or the operating programmes of the energy sources, so-called re-dispatching. Cross-border connections and the possibility of importing electricity in special cases of security of supply increase the flexibility of operation. The underdeveloped transmission network contributes to the lack or limitation of imports, which reduces the response capacity of the Transmission System Operator (PSE S.A.) in emergency situations.[15]

Prior to the onset of the fuel crisis, the development of the energy industry towards so-called civic energy was forecast, together with the future development of electro-mobility, which was expected to increase the importance of the end consumer in the electricity system segment. New generation technologies, wind or solar power plants, were expected to significantly reduce the final cost of electricity production. Energy prices were forecast to fall further[16] and the development of energy

[14] Flexibility in the Power System. The need, opportunity and value of flexibility. DNV GL, White Paper 2017.
[15] Terlikowski P., Paska J.: Methodology for polish power system cross-border transmission capacity calculation with particular emphasis on the asynchronous tie-lines; Przegląd elektrotechniczny nr 3/2018.
[16] Integrating Variable Renewables in Poland | Eight points on integrating variable renewable energy to the Polish power system; Forum Energii

storage technologies, which was intended to allow individual consumers to achieve partial energy independence and contribute to the decentralisation of the energy sector. With the growing share of microgeneration, the specifics of the segment’s operation were set to change. The progressive digitalisation of the sector continues to be one of the key factors to optimise the operation of the electricity grid (smart grid, FDIR, smart metering) and increase the opportunities for active use of resources connected to the distribution network.

One of the most significant challenges for the NPS is to remodel and increase the flexibility of the electricity system. Flexibility is the ability of the system to maintain continuous operation under conditions of rapid and large fluctuations in electricity generation and consumption. It is an integral element, taken into account in the design and control of the operation of the electricity system, which has always operated in a way that allows both area and temporary balancing of generation and consumption while maintaining the necessary reserve. In the past, flexibility in the NPS was provided by centrally dispatched generating units.

In a modern system, the key to increasing flexibility will be to harness the capabilities of all participants. The electricity market will become the tool for their activation.[17] The flexibility options are characterised by varying degrees of alignment with the system’s planning time frame:

- short-term flexibility (from a few seconds to about 15 minutes) – required for real-time electricity balancing;
- medium-term flexibility (from an hour, a few hours to a day) – required in the day-ahead and intra-day markets to plan generation volumes to balance forecast demand or to plan for resources resulting from incorrect forecasts of RES with variable operation;
- Long-term flexibility (months, years) – related to the anticipation of long-term changes such as: capacity for long-term: peak power demand coverage, network development planning, generation or efficiency improvements.

A feature of the current electricity system is the concentration of resources in the transmission system to provide flexibility. Processes taking place in the NPS, in particular the development of RES mainly connected to the distribution system and the increase in the number and variety of end-use

[17] Maćkowiak Pandera J.: Przyszłość-elastyczność w pakiecie zimowym; Konferencja Elastyczność KSE. Zmiany na REE; Forum Energii 2018.

applications of electricity, including the development of electro-mobility, require the participation of these resources in ensuring the necessary level of flexibility in the operation of the NPS. In Poland, measures have been and are being taken to increase flexibility of operation, which mainly concern resources connected to the transmission network (e.g. construction of gas peaking units). This includes both the development of networks and cross-border connections and increasing the flexibility of system operation of generating units. Based on the modernisation projects already launched for the existing centrally dispatched units, it is expected that they should be adapted for multiple start-ups per year (around 200), operating a reduced number of hours per year (around 1,500 to 4,500) and characterised by short start-up times, low technical minimum values and the ability to change their workload quickly.

The regulatory service markets – balancing and energy – must become platforms where the Transmission System Operator (and in the future the Distribution System Operator) can submit bids for the purchase of technically defined products and other users (generators and consumers) can submit bids for the supply of these products at a defined price. This will ensure safe and reliable functioning of the NPS and minimise the costs of security of supply. Changes to the existing functioning of the markets should concern in particular:

- the development of more liquid short-term markets in which everyone can participate on an equal footing, with electricity prices reflecting incidences of energy scarcity and oversupply and allowing the flexibility offered by individual system users to be valued;
- implementation of solutions enabling the use on energy markets: balancing and regulating services of the flexibility (regulation) potential of all system users, i.e. generators (system power plants, CHP plants, RES) and consumers (including aggregated individual consumers), regardless of their place of connection to the power grid;
- spreading the implementation of Advanced Metering Infrastructure (AMI) solutions to indirectly influence consumer behaviour by means of price incentives, e.g. multi-zone tariffs and real-time pricing;
- supplementing the energy pricing mechanism with the cost of supplying energy to the final consumer. This will create price incentives for the location of new energy sources.

2.5. Consequences of not adapting the NPS to changing system operating characteristics.

Poland’s energy transition has been slowed down by restrictions on the ability of distribution and transmission network operators to connect new distributed RES sources to the grid. Between 2015 and 2021, operators issued more than 6,000 grid connection refusals for power generation installations (mainly RES) with a total capacity of approximately 30GW, representing more than 50% of the currently installed generation capacity of all types of sources (conventional and renewable) in Poland in April 2022. Based on the analysed documentation of specific administrative and court cases and interviews with RES investors, the grid connection process is one of the most uncertain and difficult stages of the entire investment process. Among the most serious problems of the connection process, investors include:[18]

- lack of a consistent methodology for processing applications for connection conditions;
- inconsistency with regard to the notion of completeness of the connection application, discretion and discretion in defining the investor’s obligations, resulting in a prolongation of the connection process;
- lack of up-to-date information on the actual available connection capacity at the network points concerned (Main Point of Supply – MPS);
- failure to inform investors when capacity will be available at a given connection point, making long-term planning of RES investments difficult;
- the indication by the operators in the connection conditions of connection points far away from the planned investment, which makes the investment no longer profitable;
- lack of legal mechanisms prohibiting the blocking of connection points by investors who do not intend to carry out RES investments, but only later sell a RES project with obtained connection conditions.

The national electricity system requires immediate regulatory changes that will increase its flexibility and adapt it to a higher share of renewable energy (while ensuring the operation of large-scale, emission-free system sources, independent of fuel market fluctuations). Changes should include allowing the construction of direct lines as well as the sharing of distribution cable capacity by different generation sources, increasing the role of the Distribution Grid Operator in managing energy flows on the grid and introducing a legal framework and incentives for flexibility services. Due to the significant increase in the number of RES micro-installations in the electricity system (396,000 micro-installations,

[18] Sieci – Wąskie gardło polskiej transformacji energetycznej, Lipiec 2022 | The grids – the narrow throat of Poland’s energy transition), July 2022

mainly photovoltaic sources, were connected in 2021), operators are starting to have problems balancing the energy from these installations, resulting in an increase in the number of outages by operators. An excluded installation does not generate electricity, so consumers cannot consume the energy produced or benefit from the support scheme designed for this purpose.

2.6. National energy security.

The key parameters that unambiguously indicate the power quality of the National Power System are (ranked in order of importance):

- Availability,
- Flexibility of the source’s performance,
- Price.

The most expensive is the energy we need and are not able to dispose of. It should be noted that RES energy (mainly wind and sunlight, but also hydroelectric power plants) only fulfils the third condition in this respect – “only the fuel is free”. While large reservoir retention allows for the right level of accessibility and control flexibility in the case of hydroelectric power plants, we cannot build a hydropower facility of the right size at every location on a river (the volume of the reservoir is also an obvious limitation). In the case of wind and solar sources, both the availability of energy and the flexibility of operation are dependent on further variables (weather conditions and their variability, season). For this reason, even a large (the larger the more favourable) installed capacity of energy sources generated by RES cannot constitute the dominant share of the country’s total energy mix. In such a case, without the installation of a number of (at present inefficient for technological reasons) large-scale energy storage facilities on the grid, it would not be possible to balance energy in a proper way. Such a state of affairs would result in massive power outages and/or major failures of transmission, distribution, switching and protection infrastructure. The development of RES generation units is very important and will force the development of increasingly efficient storage technologies. On the other hand, it is not capable of ensuring the full stability of the system. Its optimum share in the system is currently between 30 and 50%. The main part of the energy in the NPS must come from available and flexible sources. Ultimately, these should be emission-free and stable nuclear sources. For the duration of their construction and commissioning, the main transitional energy carrier must be sources currently available, assuming that natural gas is obtained from sources within the European Union’s strategic alliance.

The Russian attack on Ukraine has reformulated the concept of energy security and reinforced the European Union's conviction that it is necessary to end coal, gas and oil imports from the Russian Federation as soon as possible, to change its policy on planned large gas installations and to build its own energy sources, independent of geopolitical turmoil and the raw materials market. In recent years, it was the renewable energy industry that proved most resilient to the COVID-19 pandemic and the

economic crisis it caused. The significant increase in installed photovoltaic capacity shows a huge interest in RES investments, both in the large investor segment and in private households. There was also a lot of interest in investing in wind farms, at least until the introduction of the Wind Power Investment Act (the so-called Distance Act)[19], whose regulations in practice limited the possibility of new installations of this type. Despite the worsening administrative and legal conditions, interest in the construction of other new RES sources, particularly photovoltaic installations, is not waning. At the end of 2021, the number of all micro-installations (most of the connected micro-installations are photovoltaic installations which are mainly private installations) and installations connected to the distribution network equalled 854,000, with 396,000 connected in 2021 alone, while already in March 2022, the number of micro-installations connected to the DSO network exceeded one million.[20] However, the pace of change was not withstood by electricity grids, as evidenced by the scale of refusals to connect generating installations. According to data published by the President of the Energy Regulatory Office, the number of connection refusals in 2021 increased by 70% compared to 2020 and amounted to as many as 3751 cases, representing mainly RES installations.

2.7. Legal order in the area of RES.

Consulted in March 2022, the draft law amending the Renewable Energy Sources Act and certain other laws dated February 24, 2022[21] was adopted by the Council of Ministers on April 25, 2023. The amendment covers, in particular, the area regulations selected by the legislator that require changes or extensions to the current content of the provisions. The Act also aims to partially implement the European Parliament and Council Directive 2018/2001 of December 11, 2018, regarding the promotion of the use of energy from renewable sources – RED II – into the Polish legal order. The legislator in the draft has proposed changes in the following main areas:

- Bio-methane;
- Energy clusters;
- Transposition of the RED II Directive in the following areas:
    - District heating and refrigeration (art. 23–24 RED II);
    - Guarantees of origin (art. 19 RED II);

[19] Ustawa z dnia 20 maja 2016 r. o inwestycjach w zakresie elektrowni wiatrowych, t.j. Dz. U. z 2021 r. poz. 724 | Act of May 20, 2016 on investments in wind power plants, i.e. Journal of Laws 2021, item 724
[20] "Energetyka Dystrybucja Przesył", Polish Power Transmission and Distribution Association, 2022
[21] Draft Act amending the Act on renewable energy sources and certain other acts (project number UC99 in the list of legislative and programme work of the Council of Ministers). Draft dated 24 February 2022.

  - National RES Contact Point (art. 16 RED II);
  - Administrative procedures (art. 15–16 RED II);
  - Peer-to-peer energy trading (art. 21 RED II);
- Upgrading renewable energy installations;
- Operational support for RES installations with a 15-year support scheme expiring;
- Hybrid RES installations;
- Offshore wind energy (supplementary provisions);
- Other regulations.[22]

The legislator proposes to introduce a defining concept in the RES Act, as well as to set out the rules for its production activities, including the requirement to obtain registration in the relevant register. The legislator also envisages the introduction of bio-methane to gaseous fuels in the Energy Law and in the Regulation of the Minister of Climate and Environment amending the Regulation on detailed conditions for the operation of the gas system. The aim of the regulations in question is to try to exploit the potential of bio-methane as a source of green gas and an alternative to natural gas supplies, as part of supporting the country's energy diversification. Another important area of the project under way is the proposed legislation to extend and modify the solutions dedicated to energy clusters. The provisions of the RES Act in force to date set out in very general terms the rules for undertaking and carrying out business activities in the field of energy clusters. The draft proposes to amend the definition of an energy cluster, including a requirement that at least one local authority is a party to the agreement. The catalogue of participants in such an agreement is to be open and remove the current barriers to participation in the cluster, including moving away from the incomprehensible exclusion for entities under Article 331 of the Civil Code, such as partnerships. In addition, the scope of the cluster’s activities was supplemented by the issue of energy storage.

The changes are aimed at extending the functionalities involved in the trading of guarantees of origin, both in the area of the local market and in the area of cross-border exchange. Among other things, the draft touches on the area of rules for issuing and cancelling guarantees of origin, including the extension of the types and energy carriers for which guarantees of origin can be issued, i.e. bio-methane, heat, cold or renewable hydrogen. For carriers such as bio-methane, renewable hydrogen or heat or cold, the amendment provides for the possibility of issuing a guarantee of origin for the case of supply of energy through a direct line, as referred to in Article 3 para. 11f of the Energy Law.

[22] Rynek energii elektrycznej i gazu w Polsce, Raport TOE, Warszawa 27 maja 2022r.

The Act provides for the establishment of a definition of peer-to-peer or P2P energy trading from RES as: the sale of energy from RES between market participants, of which a private renewable energy generator or a private collective renewable energy generator is the generator on the basis of an agreement specifying, in particular, the terms and conditions for the automated execution of and payment for the transaction either directly between these market participants or through a third-party market participant. Importantly, a renewable energy trading partner platform, which is understood to mean an online trading platform as defined in Annex 2 of the National Cyber Security System Act, will be able to be used to conclude agreements between P2P trading participants. The execution of the transaction itself and the execution of the payment will be able to be carried out either directly between the parties to the transaction or with the intermediation of a third party. Such automatic execution of transactions and payments can occur directly between its parties, e.g. via blockchain technology, or via a third-party market participant (e.g. an Aggregator). P2P trading is a component of the new electricity system operating model, which involves the exchange of energy between two or more participants, so-called ‘peers’, which is expected to lead to consumers switching between different suppliers.

2.8. Development of energy storage technologies.

Particularly important issues for the proper development of onshore renewable energy sources are those related to restoring the possibility of a consistent development of onshore photovoltaics and wind farms installations (and hybrid systems) supported by a coherent legal order for the development of energy storage methods. Energy storage is one of the options for increasing flexibility and energy security. Supported technologies could be battery energy storage and other energy storage solutions – for example in the form of thermal energy, using industrial gases (hydrogen) or pumped hydroelectric energy storage. For the above reasons, the amendment to the Energy Law of May 20, 2021 introduced a number of regulations regarding electricity storage and electricity storage facilities and their establishment, licensing and connection of storage facilities to the grid both as stand-alone units and as part of generation and load facilities.

The storage of electricity taken from the grid by an electricity storage facility that is part of a renewable energy source (RES) installation or a hybrid RES installation is a special case as defined in this amendment. This storage does not affect the entitlement to receive certificates of origin, guarantees of origin, the entitlement to participate in FIT/FIP schemes and in the auction system with regard to

the right to a fixed purchase price or the right to cover a negative balance, provided that the requirements set out in Article 45 of the RES Act are met. According to this provision of Article 45, an electricity storage facility which is part of a RES installation or of a hybrid RES installation shall be equipped with a metering and billing system to record the amount of electricity injected into and exported from the electricity storage facility, independently of the metering and billing system which records the amount of electricity taken from the grid and injected into the grid by that RES installation or hybrid RES installation. The storage facilities described above ensure the supply of electricity generated by RES installations when – for technological reasons – these installations are not in operation (e.g. at night or in windless weather). Thus, energy storage facilities facilitate the absorption of excess energy and the synchronisation of generation sources, including renewables, with the grid. The new legislation introduces and at the same time unifies the definition of energy storage that appears in various laws, defines the rules for connecting storage to the grid and introduces favourable solutions for energy storage billing. Until now, it was possible to carry out the business of energy storage without a licence from the President of the ERO. Currently, the legal situation is normalised – the amendment introduces the requirement to obtain a licence from the President of the ERO for storage facilities above 10 MW. Storage facilities from 50 kW to 10 MW, on the other hand, will only require registration in an appropriate register of a registry nature to be maintained by the electricity system operators (TSO and DSO). Energy storage billing, on the other hand, will be done according to the so-called balance rule. This means that network charges will only be levied on the difference between the energy consumed and the energy injected into the network. This will remove the double charging of distribution and transmission fees – for energy taken from the grid to storage and returned from storage to the grid. According to the amendment to the Power Market Act, electricity storage facilities can now participate in the power market as physical generating units if they are separate physical units and have the capacity to supply power to the system. Storage facilities can also participate in the market as part of a physical demand reduction unit. The difference comes from the way the storage facility is connected to the electricity grid – either directly to the grid or via a connection to a physical demand reduction unit (load installation).

2.9. Nuclear power development.

The assumptions of Poland's Energy Policy until 2040 (PEP 2040) resulting from the EU’s “Fit for 55” package of legislation clearly indicate that the target source of emission-free primary energy in the system will be nuclear power. As already mentioned, RES sources will be an important contributor to balancing energy demand and supply with a significant share of the total installed

capacity in the National Power System. With regard to system sources, only proven high-power technologies should be considered (solutions based on prototype SMR modular solutions, which will in future be dedicated energy sources for energy-intensive consumer installations such as chemical industry plants operating continuously). For system power unit solutions, there is a narrow group of technology providers. The project is currently in the early stages of preparation. An extremely important strategic aspect is the continuing high public support for the construction of such generating units (above 70% – with an upward trend) for several years. We currently have an indication of the construction site proposal (which must be approved through a process of documentation analysis and risk assessment according to IAEA guidelines) as well as the amended Atomic Law and the specified nuclear regulator: National Atomic Energy Agency. As part of its remit, the Office of Technical Inspection will also be the supervisory authority for the certification of safety and quality assurance systems.

Among the issues related to the development of nuclear power in Poland, those related to economic issues cannot be overlooked. A strategically important area of preparation for investment implementation will be the identification of a funding model. This aspect should be analysed over a broad time horizon, taking into account the possible far-reaching consequences of its choice. A thorough analysis of the funding model will identify opportunities and risks of adopting its final form. It is important to bear in mind that financing offered by technology providers can also be burdened by long-term consequences and affect the availability of implementation for the resources of national actors.

According to PEP 2040, the first nuclear unit of 1-1.6 GW will be commissioned in 2033, with subsequent units to be commissioned every 2-3 years – the entire nuclear programme assumes the construction of six units by 2043. The timing is a result of anticipated capacity losses in the NPS, which is also related to the increase in demand for electricity. Nuclear power plants provide stable power generation with zero air emissions. At the same time, it is possible to diversify the structure of energy generation at a reasonable cost. Current technologies (Generation III and III+) and strict global nuclear safety standards ensure high safety standards for nuclear power plant operation and waste storage. A significant part of the nuclear programme can be realised with the participation of Polish companies. There is also potential for the use of high-temperature reactors

(HTRs), which, while not an alternative to large-scale light-water nuclear units, could in future be used mainly as a source of process heat for industry.[23]

The PEP2040 update, expected in the near future, is likely to be supplemented with a with a second project for the construction of a large-scale nuclear power source, which will be a commercial project implemented by the company PGE PAK Energia Jądrowa S.A. PGE PAK Energia Jądrowa S.A. is the name of the joint company between PGE Polska Grupa Energetyczna and ZE PAK, which will take part in the in the implementation of the construction of a nuclear power plant in Konin/Pątnów in the Wielkopolska region. The aim and objective of the company will be to participate in the planned construction of a nuclear power plant in Konin/Pątnów in the Wielkopolska region. The power plant is planned as a joint venture between PGE PAK Energia Jądrowa S.A. and Korea's KHNP. The investment will be based on safe and proven APR 1400 reactor technology. PGE PAK Energia Jądrowa S.A. is tasked with preparing three elements of the investment: a study of feasibility, site and location studies and an environmental impact assessment for the planned construction of a nuclear power plant.

2.10. Offshore wind energy.

The offshore wind energy potential in the Baltic Sea is estimated at 83 GW, of which the Polish part of the basin accounts for approximately 28 GW (according to WindEurope). The potential for the development of Polish offshore wind energy has been officially confirmed in the latest spatial development plan for internal waters, the territorial sea and the exclusive economic zone and in PEP2040. In its current form, PEP2040 envisages achieving around 5.9 GW by 2030 and around 11 GW by 2040, while with the planned update of the document it is not impossible that future assumptions will be increased. Currently developed projects in the Polish exclusive economic zone that have been granted permits for the construction and use of artificial islands, structures and equipment are: Baltic I, Baltic II, Baltic III (Polenergia /Equinor), Baltic II (RWE), BC-Wind (EDPR/Engie), owned by private entities, and projects co-developed by companies with Treasury participation: Baltic Power (PKN ORLEN/Northland Power) Baltica 2 and Baltica 3 (PGE/Ørsted).

In June 2021, the President of the ERO issued the last decision on granting support for the so-called Phase I offshore projects, which takes the form of a differential contract and is issued on

[23] Ministry of Climate and Environment; “Poland’s Energy Policy until 2040”.

the basis of the Act of December 17, 2020 on the promotion of electricity generation in offshore wind farms (the so-called Offshore Act). Producers who were awarded a contract gained the right to cover the negative balance of the electricity price. The basis for the settlement of this balance is the maximum price, set by the Minister of Climate and Environment at 319.60 PLN/MWh in a decree signed on March 30, 2021. Support was given to 7 projects with a total capacity of nearly 5.9 GW: Baltic II, Baltic III, Baltic II, Baltic Power, Baltica 2, Baltica 3, BC-Wind. In November 2021, the Ministry of Infrastructure started publishing notices of the possibility to apply for new location permits for offshore wind farms. The permits relate to 11 locations designated in the spatial development plan for Polish offshore areas, with an estimated potential for buildable installations of around 10 GW of power. Investors who win permits will be able to participate in auctions planned for 2025 and 2027, where the right to cover negative balances for a total volume of up to 5 GW will be available. The new location permits and the planned auctions are elements of what is known as Phase II of offshore project development.[24]

2.11. Digital development in the energy industry.

The phrase 3D Energy, meaning decentralisation, decarbonisation and digitalisation, has been around in the energy market for many years. Its formulation was a natural process resulting from from the development of the segment and the technologies used in it. In the light of the passing of time, this slogan is becoming more and more powerful. It is the result of changing legislation and market trends. The structure of the energy market is constantly changing and the demand for energy is constantly increasing. With private consumers and RES producers connected to the electricity system, the working mechanism of electricity grids is changing and an increasing amount of information and data is required for its efficient management. According to estimates related to the energy market, the scale of the challenge will increase, as, for example, confirmed by the forecast of installed photovoltaic capacity in Poland up to 2030 presented below. Global climate policy is having a real impact on transforming the sector and stimulating the right consumer attitudes. An energy transition based on decarbonisation of the system realigns the system from a centralised to a distributed system and from unidirectional energy flows to

[24] Fundacja OPOKA; Raport „Ograniczenia polskiej przedsiębiorczości w Unii Europejskiej na tle wybranej problematyki” | OPOKA Foundation; The “Restrictions on Polish entrepreneurship in the European Union against the background of selected issues” Report

bidirectional (passive grid vs active grid). The paradigm shift, as well as the increasing demand for energy, brings major challenges that can be addressed through digital technologies as below:

- LTE 450 high-speed special communications network;
- IIOT, Industrial Internet of Things;
- AI – artificial intelligence optimising energy transmission and distribution;
- Smart Grid networks;
- Digital network and installation models – Digital twin;
- Virtual Power Plants;
- VR/AR – Virtual Reality/ Augmented Reality;
- Smart home/smart cities/energy clusters;
- Blockchain;
- Virtual energy exchange markets;
- Cloud computing;
- Data Hub.

New elements appearing in the electricity system, such as energy storage or distributed renewable energy sources, but also new market needs related, for example, to the expansion of the e-mobility market, pose real challenges to the stable operation of the NPS. On the one hand, technologies foster and ‘stimulate’ the energy market; on the other hand, such activities create challenges that require a proactive approach to the changes taking place. The traditional linear model of the functioning of energy market products is evolving into a multi-element model of interrelationships, connections and interactions between each other. This, in turn, brings with it the needs of network and generation asset management. In this aspect, digital technology offers great opportunities to solve problems and influence the stabilisation of NPS operation.[25]

2.12. Hydrogen technologies.

The determinants for the development of the hydrogen market in the EU are primarily the implementation of the current climate policy, the European Green Deal. The RES market is to play a

[25] Raport Towarzystwa Obrotu Energią „RYNEK ENERGII ELEKTRYCZNEJ I GAZU W POLSCE stan na 31 marca 2022”| Report by the Association of Energy Trading “ELECTRICITY AND GAS MARKET IN POLAND as at March 31, 2022”

major role here, with changes in the wider energy sector to reduce the consumption of industrial raw materials as part of a closed loop economy, decarbonise transport through the use of alternative fuels and decarbonise the gas sector by switching to low-carbon gases. The introduction of the RED II 146 Directive on the use of energy from renewable sources – implementation of RES support schemes – is also important. An important document is the ‘Hydrogen Strategy for a Climate Neutral Europe’ announced by the European Commission. The strategy indicates a link between RES development and the uptake of hydrogen in the economy, ultimately leading to a reduction in greenhouse gas emissions of at least 50-55% by 2030. On the initiative of the Ministry of Climate and Environment, representatives of the administration, business community, science and business environment units signed the “Sectoral Agreement for the Development of the Hydrogen Economy in Poland” on October 14, 2021 in Warsaw. According to its content, the hydrogen economy is understood as a group of technologies related to the production, transmission, storage and use of hydrogen to decarbonise the economy. The Polish Hydrogen Agreement is a response to the global challenges of combating the effects of climate change and, in its content, proposes a number of solutions that are part of the transformation of the Polish energy sector. The EU’s climate and energy policy framed by the European Green Deal has had a significant impact on the design of this Agreement.

The Hydrogen Strategy for a Climate Neutral Europe (EU Hydrogen Strategy), adopted in 2020, confirms the aim to increase the share of hydrogen in the EU energy mix from the current 2% to 14% by 2050. On 7 December 2021, the full version of the “Polish Hydrogen Strategy to 2030 with an Outlook to 2040” was also published in the Monitor Polski. The hydrogen strategy sets out, among other things, the following objectives until 2030:

- installed hydrogen production capacity: 50 MW by 2025 and 2 GW by 2030;
- number of hydrogen stations: at least 32 by 2025;
- creation of the Hydrogen Valleys Innovation Ecosystem (5 Hydrogen Valleys);
- the development of a legislative hydrogen package in 2022 and 2023 – legislation setting out the details of how the market will operate, implementing EU law in this area and implementing an incentive scheme for low-carbon hydrogen production;

In total, over the period 2021-2030, the necessary investment in the implementation of hydrogen technology in public transport, together with the necessary infrastructure and the achievement of the assumed capacity of installations from low-emission sources at 2 GW, will amount to approximately 11 billion PLN.

The strategy outlines 6 areas:

- Deployment of hydrogen technologies in the power and district heating industries.
- The use of hydrogen as an alternative fuel in transport.
- Supporting the decarbonisation of industry.
- Hydrogen production in new installations.
- Efficient and safe transmission, distribution and storage of hydrogen.
- Creating a stable regulatory environment.

2.13. Transforming the district heating sector.

The district heating sector is one of the most difficult challenges facing the energy sector. A particular obstacle in the path of transformation of this sector is the limitation in the possibility of using natural gas as a full-scale transitional fuel. On the one hand, there is growing pressure to improve air quality; on the other, the geopolitical environment is forcing decisions to be made according to the principle of “choosing the lesser evil” due to the need to ensure the thermal comfort of the population. District heating in Poland has an important role to play, but first it must undergo major changes – in technological, regulatory and business terms. It is necessary to emphasise and create the right instruments to encourage increased investment in energy efficiency. Particularly as Poland’s district heating system is one of the most extensive in Europe (behind Germany and Ukraine).

Climate policy objectives, but above all the availability of fuels, require the sector to change its philosophy on heat generation and successively convert retrofitted systems – where technically justified – to RES (electrification of district heating). Potentially increasing the number of available heat streams results in the need for a hierarchy of sources. Currently, district heating network dispatchers are obliged to purchase heat from RES, provided that the heat extracted does not exceed the heat demand of the system and the heat price is not higher than the average price of heat from other sources in the system. In order to meet the requirements set by PEP 2040, it is necessary to implement an extended hierarchy that takes into account more variables and heat sources. The extended hierarchy should prioritise locally available fuels, including: RES, the calorific fraction of waste that cannot be recycled, waste heat from industrial processes.

The proposed order of heat purchase by the district heating network dispatcher is as follows:

- The total heat flow from the thermal waste treatment unit, as a proportion of the locally sourced waste fuels, to the total fuel stream consumed for the combustion process in that unit (work priority in basis).
- The entire waste heat stream, including heat recovery from industrial processes and also, for example, heat pumps from wastewater or reversible (priority operation in the base).
- Geothermal, heat pumps other than those qualifying for the point above, solar thermal installations in operation on the carrier return or under the heat curve.
- Heat from other RES installations in the amount resulting from the share of the amount of fuels constituting renewable energy sources in the total fuel stream consumed for the combustion process in that unit (priority of operation in the base).
- The entire heat flow from a set of sources (which includes at least one co-generation unit) supplying heat to a single district heating system, when the entire set of sources ensures the efficiency of that district heating system and meets all environmental standards and provides heat with an appropriate non-renewable energy input factor (base operating priority).
- The entire heat flux from the high-efficiency co-generation unit (operation under the heat curve and, where several sources exist in the system, proportional to other sources).
- Other types of heat (work proportional to other sources).

The predominant fuel in the heating industry is hard coal. The second most popular fuel for heat supply is natural gas, accounting for over 9.5% of heat production in the licensed district heating sector. Renewable energy sources are becoming increasingly important in the heating sector in the context of the EU’s rapidly changing regulatory policy, accounting for 9.5% of heat production. Of this figure, 97.5% is accounted for by biomass, 0.4% by biogas and 2.1% by other RES.[26]

Regardless of the implemented model for the operation of the district heating system during the energy transition, the priority remains the replacement of heat sources in the individual sector, which is responsible for the majority of atmospheric pollution and is extremely inefficient.

[26] Ministry of Climate and Environment, “Strategia dla ciepłownictwa do 2030 z perspektywą do 2040r.”

Chapter 3:

New technologies and old natural resources as a solution for future generations on energy security.

3.1. Introduction.

The definition of national energy security is defined as follows: “In an era of high rates of technological, economic and social development, a stable and uninterrupted energy supply is one of the key components that determine a country’s economic sovereignty, its position in international relations and the quality of human life. The importance of the raw material and energy base of the economy is due to the special role of natural resources in the modern world. This has to do with the phenomenon of exhaustibility and the inability to diversify their distribution. Furthermore, the export of indigenous raw materials is an effective instrument of political pressure and an element of influence on both regional and international policy.”

The ground-breaking nature of these problems is particularly indicated by the fact that the issue of pursuing an informed energy policy is being addressed in view of the intensification of a number of threats related to dynamic processes in Russia, tensions and conflicts in the Gulf region and China’s growing demand for oil and gas. This is also the result of changing production and consumption patterns, the tightening of climate regulations by the European Union, limited extraction capacity from indigenous deposits, the low efficiency of the share of renewable energy (including the lack of efficient carbon-free sources such as nuclear power plants), fluctuating fossil fuel prices, the increasing energy intensity of the economy, and the increased difficulty of forecasting expected electricity supply and demand.[27]

In principle, the definition of energy security before and after February 24, 2022 is up to date. Nevertheless, in a period of serious geopolitical disturbances (and such is undoubtedly the unprovoked armed aggression of the Russian Federation against Ukraine), certain assumptions of the energy transition should be redefined with particular attention to conducting it in a way that ensures greater resilience to the risks arising from the unauthorised actions of third parties with “tools of influence” in the form of strategic energy supplier status, technology or the possibility of unauthorised access to the NPS’s information-technical security infrastructure network. Accordingly, the definition of energy security should be updated to include the identification of particularly vulnerable areas of the system,

[27] I. Jankowska, “Energy security in the state’s security policy”, PWSZ IPiA Studia Lubuskie.

the development of which should take place within a well-defined framework ensuring that the risk of adverse events is minimised.

The foundations of energy security in the energy transition period include:

- designation of key supply routes for transitional energy carriers within the framework of strategic alliances and secure reserve supply routes;
- identifying the abundance of domestic deposits for critical partial self-sufficiency in energy;
- maintaining the technical availability of energy carrier deposits for exploitation in critical situations or for future use with the implementation of new clean processing technologies;
- optimising and appropriate development of storage capacities for energy carriers within the country;
- liberalising the market and creating competitive conditions with attention to the use of technologies that are resilient to external disruption;
- developing the infrastructure and taking care of the technical state of the transmission and distribution system;
- building large-scale, emission-free and safe energy sources (nuclear power);
- developing renewable energy sources in parallel with energy storage technologies,
- developing hydrogen technologies as methods of energy storage and substitution of fossil raw materials in chemical synthesis processes;
- securing the safety priority of infrastructure enabling the import of energy carriers and raw materials (gas pipelines, LNG regasification terminals, undersea power lines);
- monitoring the political stability of the regions responsible for exporting the necessary fossil raw materials.

3.2. Fossil substances – fuels and raw materials.

In the common communication and understanding of the issue, very often the concepts of fuels and raw materials are understood to be the same. While they involve the same substances, differentiating between them in terms of technological use is crucial. These substances (coal, lignite, natural gas and oil) used as fuels in technological processes undergo the simplest chemical transformation, which is combustion. In this case, the only expected effect of the transformation is the release of as much heat as possible, the purpose of which is to indirectly generate steam from heated water or to directly utilise

the rapidly increasing volume of the flue gases in relation to the volume of the fuel itself. The main and undesirable side effect is the formation of large quantities of volatile substances (flue gases), which are dispersed into the atmosphere in technological processes (after cleaning, cooling and dust removal). At this point, we are losing control over them and their ever-increasing contribution to the atmospheric content is influencing adverse climate change on Earth. When the aforementioned substances are used as raw materials in production processes, the starting composition of the post-process substances is defined and is for the most part under technological control.

Distinguishing between these substances, taking into account their technological purpose, makes it possible to properly agree on priorities in the process of systematically reducing the consumption of fossil resources: in the first instance, we should abandon their use as fuels burned to generate heat with free emissions into the atmosphere.

Reducing the use of fossil substances as fuel will stabilise their supply in terms of raw materials. Unfortunately, the global crisis caused by the environment and geopolitical situation also affects the raw material sphere, as the distinction made is not taken into account at the extraction and transmission stage. Nevertheless, an awareness of this division allows the identification of strategic supply routes for these substances to meet raw material demand.

3.3. Fossil fuels – limited resources.

Globally, there is a strongly marked path directed towards a deepening reflection related to both the impact of human activity on adverse climate change and awareness of resource depletion. Confirmation of the trend can easily be seen in Figure 6, which shows the changes in global fossil fuel consumption from 1800 up to 2016. A sharp increase in the use of fossil fuel resources is clearly visible, especially after 1950.

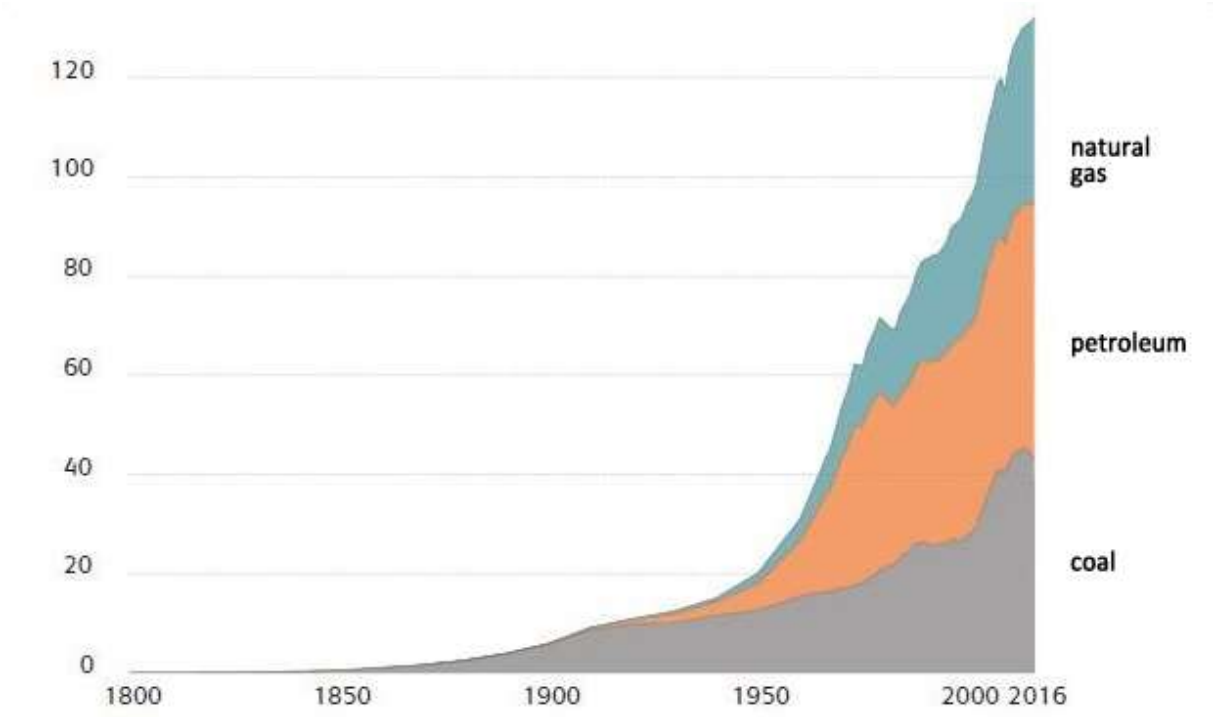

Fig. 7. Global fossil fuel consumption volumes [TWh].[28]

The introduced restrictions on the emission of harmful gases into the atmosphere have the effect of reducing the use of coal for energy and heat production. The extraction of natural gas is increasing, the appropriate conversion of which allows an energy effect to be obtained with a significantly lower gas equivalent emitted (for this reason, natural gas was recognised as an alternative transition fuel before February 24, 2022). However, many countries, including Poland, are not in a position to abandon the use of hard coal or lignite all of a sudden. This is due to the energy strategy pursued in the 20th century, in which coal and lignite accounted for the main share of the mix and the development of nuclear power was halted for socio-political reasons (Fig. 6 in Chapter 2).

The global reserves of individual raw materials are presented in Fig. 8 – 10 below. Despite the fact that Poland appears to have an above-average abundance of coal, it looks unimpressive compared to other countries. Natural gas and oil abundance is even worse. In principle, this situation applies to the whole of Europe (for obvious reasons, the European part of the Russian Federation is not included in this consideration).

[28] https://www.cire.pl/artykuly/materialy-problemowe/141200-paliwa-kopalne-na-ile-jeszcze-mozemy-sobie-pozwolic

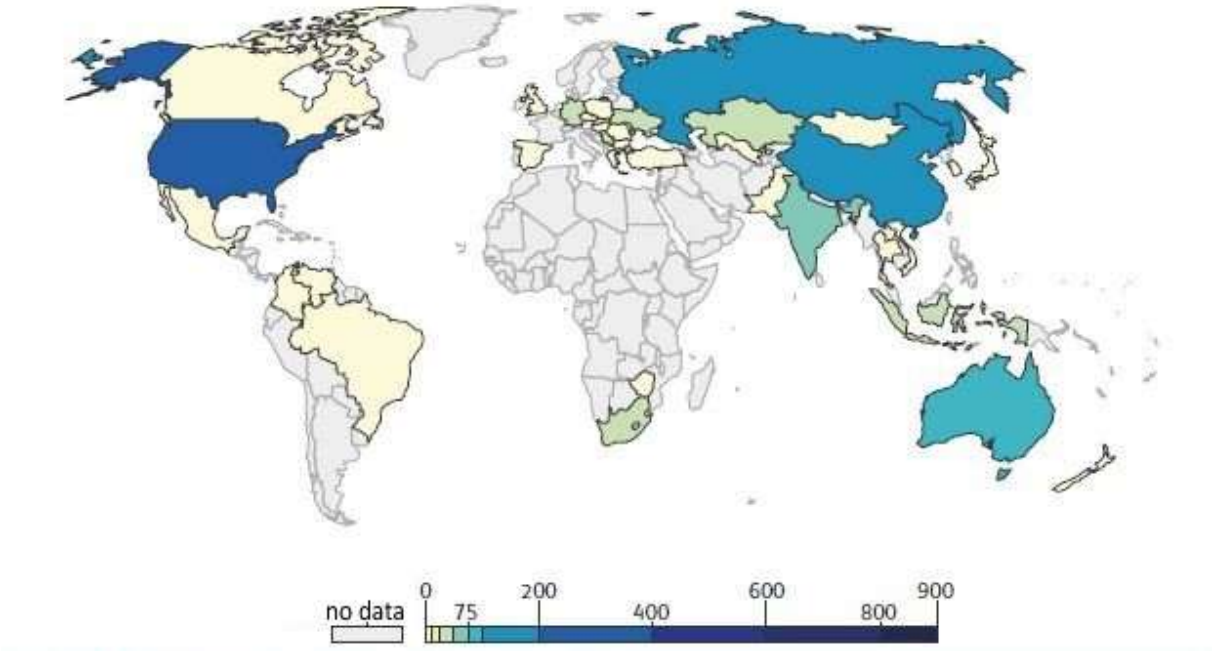

Fig. 8. Size of world coal reserves [million tonnes].[29]

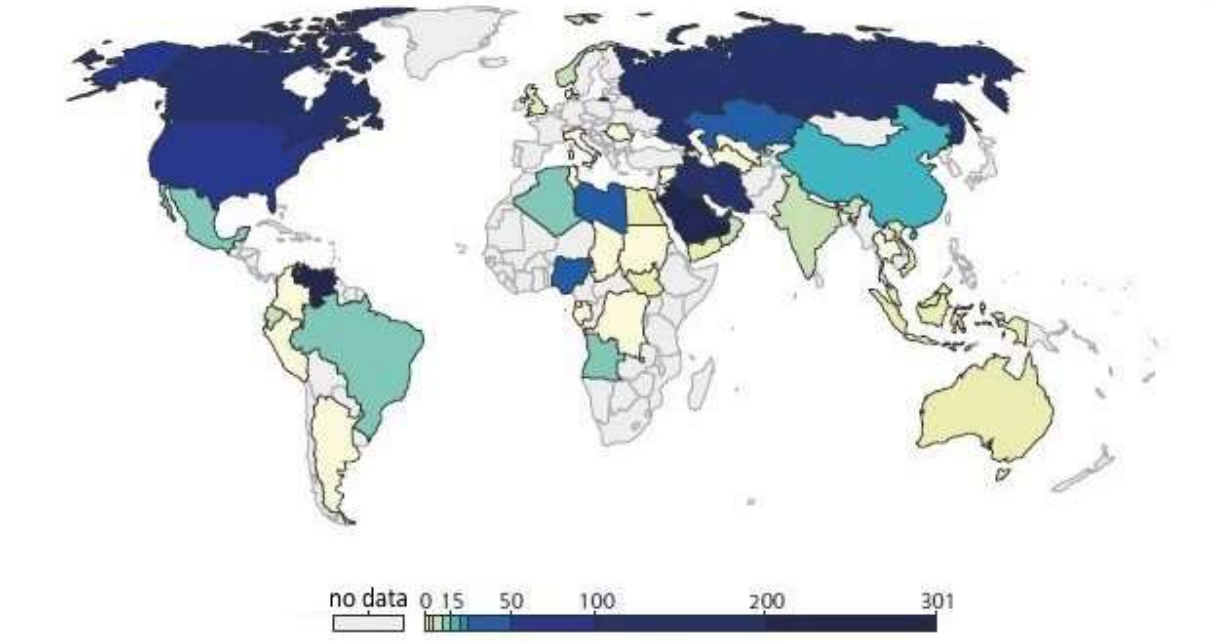

Fig. 9. Size of world oil reserves [billion barrels]. [17]

[29] https://www.cire.pl/artykuly/materialy-problemowe/141200-paliwa-kopalne-na-ile-jeszcze-mozemy-sobie-pozwolic

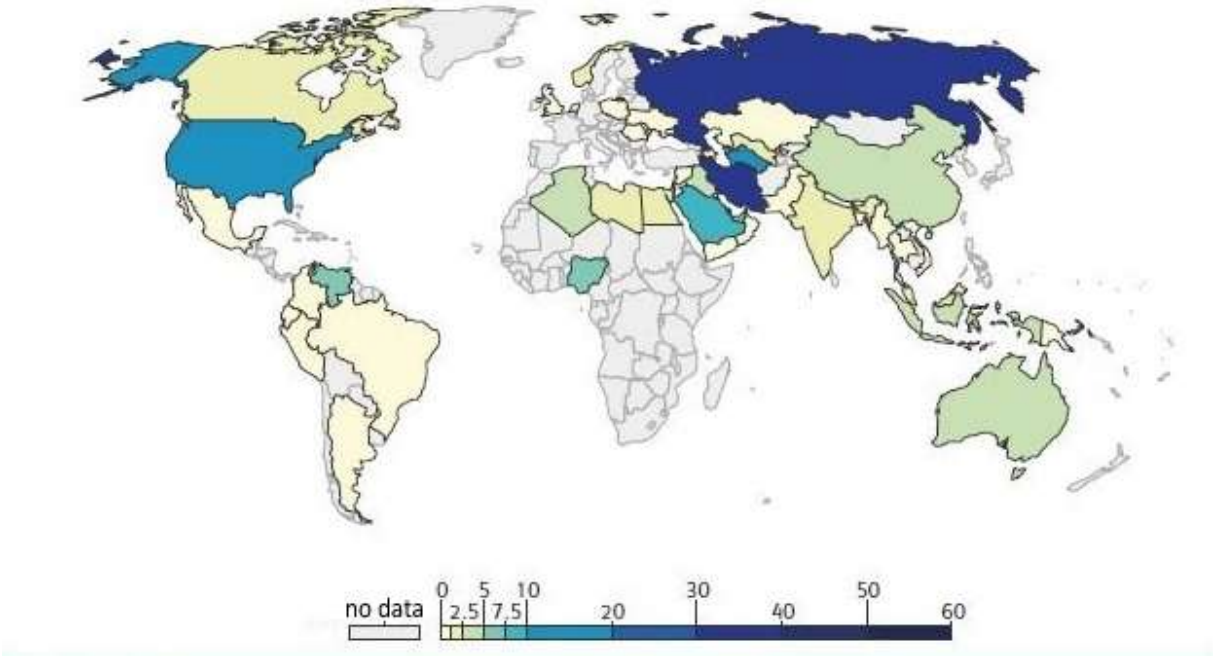

Fig. 10. Volume of global natural gas reserves [trillion m^3]. [17]

The size of the world's reserves of individual raw materials/fossil fuels is well known. Just looking at the territorial distributions of resources presented above gives the idea that fossils are tools for pressure and shaping the geopolitical situation. It is not surprising that most armed conflicts, especially over the past century, have been rooted in a struggle for raw materials. Any intervention in an extractive country involves changes in the price of oil or gas. Europe has relatively scarce resources and deposits and yet is a highly developed continent and generates significant demand for energy in all forms.

Taking into account only the recognised deposits of fossil substances (there are still prospective deposits such as shale gas deposits, deep deposits – not economical at present and so forth). Based on these figures, the time until gas and oil deposits are fully exploited is not very long (about 50 years). Twice this value is observed for coal (projected lifetime of approximately 110 years). The world's resources are rapidly shrinking. This is a truth universally acknowledged, which unfortunately concerns only those with the most foresight. This point of view makes it possible to see the validity of the idea of a European Green Deal.

So what scenarios can be expected in the future? Unless large-scale fossil fuel-free power generation technology combined with balancing RES sources is implemented, the outlook is critical. Armed conflicts will increase, even if they are not directly defined as a struggle over raw materials.

Undoubtedly, the United States and Russia have the advantage in terms of access to deposits (which corresponds to the current polarisation of geopolitical poles), which is primarily related to the size of the areas they occupy. A future game will be played between these countries regarding the leadership of the ranking of the most commodity-rich countries, which means that they are also economically strong. From this, it follows that energy security and independence is one of the fundamental tools for maintaining the balance of power globally.

3.4. Fossil resources – industrial applications.

The key role of the three primary fossil fuels in energy has been described above in relation to their energy role as a function of global deposit distribution. The European continent is not as rich in their deposits as the United States, the Russian Federation, South America or the Arabian Peninsula. Nevertheless, their role, even after being eliminated from the energy industry, still remains significant. Especially in modern industries.

Coking coal is a key raw material for the coke-chemical industry, from which thermal processing yields important intermediates for key industries. In addition to the key role of coke in the metallurgical industry, the listed intermediates have applications in the organic and road chemicals industries. Another direction of industrial applications of appropriately selected assortments of coal, anthracite and calcined coke is the production of coal products, among which the following are distinguished: products that are graphitized, metal-graphite, carbon-ceramic and others.

Petroleum is a fossil fuel composed of many different chemical fractions. Fractional distillation is used to separate the individual components (e.g. gasoline, mazut, refinery gas) from it. Petroleum is used in the production of fuels: petrol, diesel, propane-butane (LPG), light and heavy fuel oils and aviation fuels; plastics, such as polyethylene (PE) and polypropylene (PP), synthetic rubber and synthetic fibres (nylon, polyester); paints, solvents, detergents and plant protection products.

In industrial applications, natural gas mainly serves as a raw material for the production of synthesis gas (a mixture of hydrogen and carbon monoxide), which is a basic intermediate for widespread use in chemical synthesis. It can be used to produce polymers, synthetic fuels, fertilisers and many other strategically important products.

The above summary of industrial uses of minerals is only an abbreviated picture of their actual contribution to industry. The aim of such a presentation of the importance of fossil raw materials is to make it clear that their consumption in terms of combustion processes for heat and electricity must be drastically reduced. At the same time, developments should be sought that enable chemicals for chemical synthesis to be obtained from processes accompanying green energy production (hydrogen and green ammonia extraction technologies and others).

3.5. Conclusions – policy to slow down the use of natural resources.

A fundamental characteristic of non-renewable natural resources is their depletion as a function of the time they are exploited. Different practical solutions should therefore be applied, depending on the resource to be managed. This applies in particular to energy raw materials, which can be replaced by renewable sources. The following ways are known to ensure a reduction in the consumption of natural resources, having the characteristics of the rules described:

- complete abandonment of the use of non-renewable resources,
- bringing about the creation of goods whose use will compensate for the lack of non-renewable resources,
- increasing the efficiency of their use in the production process,
- extending the life cycle and service span of products,
- a change in pricing policy for consumables, spare parts and maintenance services,
- effective waste management.

The first possibility mentioned should essentially be rejected a priori. Strong sustainability of natural resources, referring to non-renewable resources, is a rather unattainable goal in today's socio-economic and political circumstances (with regard to the global scale). Restrictive limitations on the use of natural resources would be socially unacceptable in many regions of the modern world and may be associated with the emergence of internal conflicts. The complete abandonment of the use of resources should only apply to so-called life-support capital. This capital is the resources necessary for the reproduction of life, which include the ozone layer, biodiversity, river ecosystems, marshes and forests acting as habitats. It is widely recognised that any economic use of critical capital causes significant disruption to the aforementioned ecosystems. Thus, given the societal benefits of such a ban, it may be considered. The substitution in the production process of non-renewable resources by renewable resources should be understood as a change in the technological process that allows the

use of renewable resources for the production of a specific good instead of the originally used non-renewable resources, without changing the properties and quality of the final good. An example of effective substitution of non-renewable resources is the use of renewable energy in the production process. Such a switch will certainly not affect the end result of production, but will result in a reduction in the use of non-renewable resources.

Increasing the efficiency of natural resource use in the production process is also a good way to slow down the consumption of natural resources. This process is furthermore a rationale for modernising the economy towards a reduction in factor consumption per unit of product (resource efficiency) and secondly, an increase in the quality and functionality of goods.

In the first case, it would be necessary to ensure a systematic annual decrease in the consumption of natural resources while maintaining the socially expected increase in production. This condition will be met when the increase in natural resource efficiency over a certain period of time is higher than the economic development realised at that time. However, it must be borne in mind that sustained efficiency gains over the long term are, in practice, impossible. This is because it is not a process characterised by a constant dynamic over time. So it cannot be assumed in advance that this will always be an effective method of slowing down the consumption of natural resources. In the second case, it would be necessary to ensure the quality of the products to extend their life cycle (use). There is, however, a contradiction in this statement, as the creation of ever new customer needs and the offering of products to meet these needs lie at the heart of marketing. However, environmental barriers and opportunities for socio-economic growth need to be objectively assessed and further development needs to be programmed on this basis.

The amount of available resources can be further increased by recycling the waste generated. It is therefore man's task to strive for their maximum reuse in order to protect the original natural resources and reduce environmentally harmful pollution, which will furthermore ensure their continued longevity and functionality. Considering the increasing trend of waste generation, and this worldwide, rational waste management and striving to reduce waste as much as possible becomes a fundamental human task if one wishes to ensure the necessary conditions for the continued existence of oneself and future generations. In this context, proper organisation of the collection and use of recyclable materials is of special importance. The problem particularly affects the packaging of products with dispersed consumption. In spite of the harmonisation of regulations in this area, if only

at community level, it can be seen in practice that both the mechanisms and the final results of the collection of recyclables vary from country to country.

Necessary at this stage of socio-economic development, slowing down the consumption of natural resources will bring tangible benefits:

- social: it will ensure that future generations have access to scarce environmental resources and thus it will also ensure intergenerational equity, which will result in a greater commitment of human capital, particularly among the highly skilled;
- economical: it will lead to a reduction in the consumption of resources as a result of an increase in the efficiency of their use or a reduction in the material intensity of production; it will contribute to lowering or at least halting the increase in the unit price of the resources themselves as a result of a fall in demand for them; it will lead to a reduction in the variable and total costs of production resulting from a lower demand for materials;
- economic: it will bring an increased interest in innovation in industry, which in turn will result in increased investment in research and development;
- environmental: will contribute to improving the environment;
- political: will improve global security and reduce the risk of international conflicts based on access to natural resources.

These benefits will imply further positive externalities, among which are: improvements in the health and living conditions of societies and the wider and more effective fulfilment of non-economic functions by the environment, e.g. recreational, cultural and ecological. As a result, despite the undoubted difficulties that will arise in implementing a new approach to the production process, sustainable and balanced development can occur relatively quickly, guaranteeing an increase in social welfare in the long term. However, the time in which this will take place largely depends on the degree of environmental education of societies, the willingness of businesses to undertake pro-environmental measures and the support of these measures by public institutions.[30]

[30] Marcin Łuszczyk: „Spowolnienie wykorzystania zasobów naturalnych wyzwaniem współczesnej gospodarki”, Instytut Administracyjno-Ekonomiczny, Zakład Ekonomii Państwowa Wyższa Szkoła Zawodowa w Tarnowie.