U. Kurczewska, *How can energy resilience be strengthened in Central and Eastern European states?*,
„Rocznik Instytutu Europy Środkowo-Wschodniej" 22 (2024), z. 1, s. 141-157,
DOI: https://doi.org/10.36874/RIESW.2024.1.8

Urszula Kurczewska*

How can energy resilience be strengthened in Central and Eastern European states?

Jak wzmocnić odporność energetyczną w państwach Europy Środkowej i Wschodniej?

Abstract: The energy crisis resulting from Russia's military aggression in Ukraine in 2022 is seen by the European Union as an opportunity to accelerate the energy transition and strengthen energy resilience. Energy resilience is particularly important for Central and Eastern European (CEE) countries, which are highly dependent on imports of energy resources and which possess significant potential for the development of energy based on renewable sources. The article presents an analysis of the energy resilience of CEE countries in the context of the challenges related to the energy crisis, Russia's war in Ukraine, and the EU's ambitious climate goals. The aim of the analysis is to identify the factors that contribute to strengthening or weakening the energy resilience of these countries. The results of the study confirm the thesis that the process of strengthening the energy resilience of CEE countries is progressing, but too slowly and unevenly. The most serious problems for these countries are the increase in the share of energy from renewable sources, the modernisation and expansion of the old electricity grid, the lack of decentralisation of the energy system, and insufficient cross-border cooperation in the field of energy exchange. The findings can help to understand the political, technological and economic challenges faced by CEE countries in their energy systems.
Keywords: energy resilience, Central and Eastern Europe, European Union, energy transition, renewable energy sources
Streszczenie: Kryzys energetyczny będący skutkiem agresji militarnej Rosji w Ukrainie w 2022 r. jest traktowany przez Unię Europejską jako szansa na przyspieszenie transformacji energetycznej i wzmocnienie odporności energetycznej. Odporność energetyczna jest szczególnie ważna dla państw Europy Centralnej i Wschodniej (CEE), które w dużym stopniu są uzależnione od im-

* dr hab., prof. SGH, Warsaw School of Economics, ORCID: https://orcid.org/0000-0001-8280-865X, e-mail: ukurcz@sgh.waw.pl.

portu surowców energetycznych, a które dysponują olbrzymim potencjałem rozwoju energii opartej na źródłach odnawialnych. Artykuł przedstawia analizę odporności energetycznej państw CEE w kontekście wyzwań związanych z kryzysem energetycznym, wojną Rosji w Ukrainie oraz ambitnych celów klimatycznych UE. Celem analizy jest identyfikacja czynników, które przyczyniają się do wzmocnienia lub osłabienia odporności energetycznej tych państw. Wyniki badań potwierdzają tezę o postępującym, ale nazbyt powolnym i nierównomiernym procesie wzmacniania odporności energetycznej państw CEE. Najpoważniejszym problemem dla tych państw jest zwiększenie udziału energii ze źródeł odnawialnych, modernizacja i rozbudowa starej sieci elektroenergetycznej, brak decentralizacji systemu energetycznego i niewystarczająca współpraca transgraniczna dotycząca wymiany energii. Wnioski mogą być pomocne w zrozumieniu politycznych, technologicznych i ekonomicznych wyzwań jakie stoją przed państwami regionu CEE dotyczących ich systemów energetycznych.
Słowa kluczowe: odporność energetyczna, Europa Środkowa i Wschodnia, Unia Europejska, transformacja energetyczna, odnawialne źródła energii

Introduction

Russia's military aggression in Ukraine in 2022, along with the consequences in the form of disruptions in supply chains, has led to an imbalance in the energy order in Europe, resulting in the biggest energy crisis in several decades. Prices for energy commodities, especially imported ones, have risen sharply, as have energy prices. This profoundly impacted the economy and greatly increased the cost of living. The crisis in securing energy supply and soaring energy prices have highlighted the vital importance of energy resilience and security. The European Union's policy response to Russia's invasion of Ukraine has been to accelerate the energy transition and enhance energy resilience. Currently, the EU is focused on a rapid transition away from fossil fuels, mainly coal, reducing demand for gas and increasing the share of renewable sources in energy production, as well as increasing energy efficiency.

The article presents an analysis of the energy resilience of Central and Eastern European (CEE) countries, including Bulgaria, Czechia, Hungary, Poland, Romania, and Slovakia in the context of the challenges related to the energy crisis, Russia's war in Ukraine, and the ambitious goals of the European Union's (EU) climate and energy policy. The aim of the analysis is to identify the factors and conditions that contribute to strengthening or weakening the energy resilience of these countries. The research proposes the thesis that the process of enhancing energy resilience in CEE countries is progressing, albeit at a slow and uneven pace. The analysis employed quantitative and qualitative

data from the databases of various national and international research and expert centres. The findings may be helpful in understanding the political, technological and economic challenges faced by CEE countries regarding their energy systems.

1. What is energy resilience?

The category of "resilience" has emerged as a new paradigm that is applicable to various fields of science and practice. In general, resilience can be defined as the ability of a system to overcome extreme events with minimal disruption and with a rapid recovery or adaptation phase[1]. The resilience of a system is related to: robustness – inherent strength in the system to withstand external demands without loss of functionality, resourcefulness – the ability to mobilize necessary resources in an emergency situation, redundancy – the ability to make choices in a situation of pressure, and rapid recovery – speed at which disruption can be overcome and system stability restored[2].

Energy resilience is defined more narrowly as "the ability to survive and reduce the scale or duration of disruptive events, which includes the ability to anticipate, absorb, adapt to, or recover quickly from such an event"[3]. However, energy resilience is not only about the technical and physical aspects of the energy system, but also about its political, economic and social dimensions. Very often, the category of energy resilience is linked to energy security, and their meanings overlap. The most important difference between security and energy resilience is the severity of the impact of a given threat and the response to it[4]. Security is treated as a specific state[5], while resilience is perceived as a process in which stages can be identified (e.g. breakdown, recovery from a crisis), and attention is focused on a possible

1 F.M. Baldursson, C. Banet, Ch. Chyong, *Building Resilience in Europe's Energy System*, CERRE, Report, June 2023, p. 7.
2 P. Joshi, C. Gokhale-Welch, *Fundamentals of Energy Security and Resilience*, National Renewable Energy Laboratory, November 2022, https://www.nrel.gov/docs/fy23osti/84499.pdf [3.04.2024].
3 F.M. Baldursson, C. Banet, Ch. Chyong, *Building Resilience*…, p. 10.
4 Cf J. Jasiunas, P. Lund, J. Mikkola, *Energy system resilience – A review*, "Renewable and Sustainable Energy Reviews" 2021, vol. 150.
5 An interesting analysis of the meaning of the term energy security and its definition is in J. Misiągiewicz, *Energy security as an area of international security*, "Stosunki Międzynarodowe – International Relations" 2022, vol. 58.

response to threats (endurance and recovery). The most common terms that are associated with the definition of energy security are "accessibility of energy resources", "reliability", "affordability", and "diversity of resources".

The concepts of energy resilience have become a staple of international security discussions over recent years and are now firmly embedded within numerous government documents, replacing, and updating policy ideas based on risk[6]. The use of the concept of resilience allows for a greater focus on identifying future security challenges, as well as ways to build resilience in the long term. Resilience is a process, but one that is characterised by a spiral rather than a linear progression, in which several phases can be distinguished (e.g. the transformation phase). It can be preventive (before, for example, a terrorist attack), but it can also occur after a crisis, in the process of reconstruction.

Russia's war in Ukraine highlights that energy resilience, and not only energy security, guarantees the survival of the economy and society in the long process of continuing armed conflicts. At the same time, it underscores that the category of resilience makes it possible to understand the complexity and multifaceted nature of the state's resilience to military threats.

Today, the most important threats to energy resilience in Europe are primarily military, terrorist, cyber and climate threats[7]. Today, these threats are intensifying both in terms of frequency and scale, and sometimes they accumulate and occur simultaneously. The main types of threats are:

- military threats – Russia's invasion of Ukraine shows how energy resilience can be threatened in terms of security of energy supply as a result of military threats. The war has caused massive damage to Ukraine's energy infrastructure. Also, the explosions and severe damage to the Nord Stream 1 and Nord Stream 2 gas pipelines have shown how seriously the physical security of supply in Europe is threatened. However, the threat

6 J. Coaffee, *Futureproof: How to Build Resilience in an Uncertain World*, Yale University Press, 2019.
7 E. Rinaldi, *How to strengthen energy resilience in an uncertain world*, Eurelectric, August 2023, https://www.eurelectric.org/in-detail/energy-resilience [4.04.2024].

extends beyond physical war damage to the energy infrastructure; this invasion has also impacted international energy markets, i.e. instability and uncertainty of supply, the risk of a sharp increase in energy prices as a result of an increase in demand, panic on the markets and increased competition, energy blackmail of the aggressor, etc.

- supply chain risks – the war in Ukraine has highlighted the extent of the risks associated with the lack of diversification of energy supplies and how dependent the EU has become on imports of fossil fuels from Russia – an unstable country that uses energy blackmail. Risky trade dependencies with unreliable partners can turn into threats or attacks on a country's security of supply. A high level of dependence on Russian energy resources concerns many EU countries.
- climate change hazards – extreme weather events: heat waves, wildfires, windstorms and floods affect energy systems, especially electricity grids. Over the past decade, extreme weather events have caused 145 billion EUR in economic losses in the EU[8]. Due to climate change, the number of such events is expected to increase.
- cyber and terrorist threats – with the increasing digitalization of energy systems and the use of AI in the energy sector, the risk of terrorist cyber-attacks is increasing. The energy system is particularly vulnerable to these types of attacks because it is a critical infrastructure. An extremely important issue of the security of energy infrastructure is the threat of a potential attack on nuclear power plants. Currently, there are numerous nuclear reactors operating in the EU – 133 in total, including 56 in France, 7 in Spain, 5-6 reactors in Sweden, Czechia, Slovakia, Finland, Belgium, and several in other countries. In addition, there are 37 reactors in operation in Russia and 15 in Ukraine[9]. The expansion of nuclear energy systems, especially large power plants, increases the likelihood of this type of threat.

8 Ibid.

9 *Number of operational, shutdown, and planned nuclear reactors in European countries* https://www.statista.com/statistics/792589/operational-nuclear-reactors-european-union-eu-28/ [1.04.2024].

2. Strengthen energy resilience in the EU

Strengthening energy resilience is a long and complex process, requiring a combination of strategies and measures, with an aim to minimise vulnerabilities and increase the capacity to respond to disruptions. The basic elements of energy resilience are: diversification of energy sources, decentralised energy generation, energy storage, smart grids, flexibility and demand response[10].

To ensure the EU's energy independence and security in the long term and to meet the ambitious climate goals of the European Green Deal, the European Commission has put forward several initiatives. The most important of these is REPowerEU, which aims to accelerate the energy transition by diversifying energy sources through increasing the share of renewable energy sources (solar, wind, geothermal and hydropower), improving energy efficiency, increasing investments in smart energy grids, and developing energy storage technologies, hydrogen technologies and electromobility[11]. Close to 300 billion EUR has been earmarked for the implementation of the REPowerEU plan in the form of grants and loans.

The problem of energy resilience is particularly acute for those countries that are highly dependent on imports of energy resources. These countries include the CEE countries. In general, the level of dependence of the entire EU on imports of energy resources, including gas and coal, is quite high. In 2021, Russia was the largest supplier of energy resources to the EU, accounting for 45% of coal imports, 42% of gas and 25% of oil, with some countries' dependency being extremely high (e.g. Russia provided 95% of Hungary's gas, 80% of Austria's gas and 65% of Germany's gas)[12]. After the EU imposed sanctions on Russia and Russia imposed restrictions on gas shipments, the share of Russian raw materials in imports to the EU in 2023 decreased: gas

10 E. Rinaldi, *How to strengthen energy resilience…*

11 European Commission, *Communication REPowerEU Plan*, COM(2022) 230 final, Brussels, 18 May 2022, https://energy.ec.europa.eu/system/files/2022-05/COM_2022_230_1_EN_ACT_part1_v5.pdf.

12 Eurostat, *EU trade with Russia – latest developments*, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_trade_with_Russia_-_latest_developments#Latest_developments [23.03.2024].

to 12% and oil to 2.3%[13]. However, the vast majority of energy resources in the EU are still imported, although from directions other than Russia. In such a situation, energy resilience and security have become a priority for the Union.

CEE countries are also striving to build their energy resilience, including through the diversification of energy sources and moving away from fossil fuels to renewable sources. However, their energy transition is to a large extent forced by the EU. CEE countries are in an extremely difficult situation, as they have to adapt to the requirements of the EU's climate and energy policy, and at the same time ensure their energy security. These countries were heavily dependent on imports of energy resources from Russia. After the Russian invasion of Ukraine, they needed to adapt their strategies to the changed, challenging geopolitical environment. This adaptation process is extremely demanding and difficult for them.

The sector that has been hit hardest by the energy crisis is electricity generation. At the same time, the importance of this sector for the economy and society is steadily growing and, according to forecasts, the demand for electricity in final energy consumption in 2040 will amount to over 50%[14]. The growing importance of electricity is due to the increased electrification of various energy services in households (spread of heat pumps, electrical heating, and other) and in industry, the expansion of hydrogen applications (in transport and industry), and the rise in electromobility[15]. Therefore, resilience in electricity production is one of the most important challenges for the EU. Due to the rapidly growing importance of electricity in the EU, this study is devoted to the analysis of the power systems of the CEE countries and the challenges they face.

13 European Commission, *In focus: EU energy security and gas supplies*, https://energy.ec.europa.eu/news/focus-eu-energy-security-and-gas-supplies-2024-02-15_en (28.03.2024].

14 European Commission, *Communication: Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society*, COM(2024) 63 final, Strasbourg, 6 February 2024, p. 13.

15 *EU Energy Outlook to 2060: power prices and revenues predicted for wind, solar, gas, hydrogen + more*, https://energypost.eu/eu-energy-outlook-to-2060-power-prices-and-revenues-predicted-for-wind-solar-gas-hydrogen-more/ [1.04.2024].

3. Energy resilience or non-resilience of CEE countries?

One of the basic conditions for the energy transition in the power sector and enhancing energy resilience in the CEE countries is the diversification of energy sources and an increase in the share of energy from RES, as well as the decentralisation of the system, its modernisation, and the expansion of power grids.

3.1 Diversification of energy sources in CEE countries

Relying on a single source of energy makes the system vulnerable to various supply disruptions. Therefore, diversification of energy production sources, including the use of renewable sources, significantly increases energy resilience. The main element of the EU's energy transition is to increase the share of RES in energy production, especially in electricity generation. Renewable sources are zero-emission, which helps to reduce greenhouse gas emissions, but above all, increases energy security. Wind and solar energy in particular are promoted because they are inexhaustible, distributed, and widely available. The Renewable Energy Directive (RED III), revised in 2023, sets a new RES target for 2030 at 42.5–45% in total final energy consumption (previously the target was 30%). Member States will have agreed individual targets.

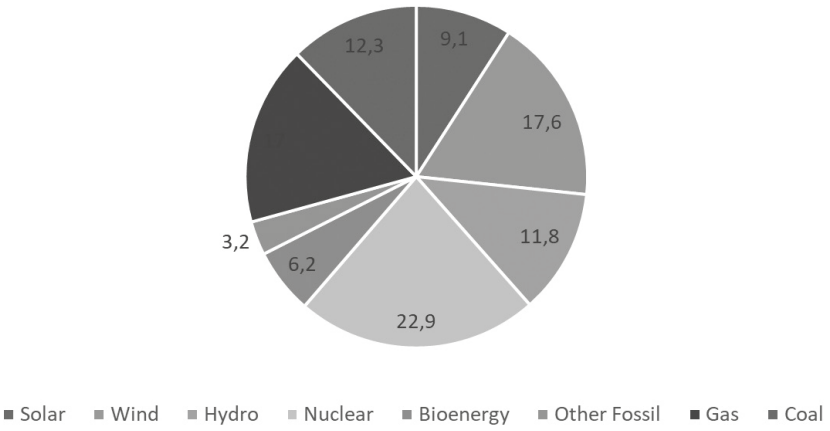
Currently, the share of RES in the EU's electricity generation is growing rapidly and reached 44% in 2023, with wind and solar power generating a record 27% of the energy[16]. This is a milestone in the EU's energy transition. In 21 EU countries, wind energy has reached an all-time high share of the electricity mix. At the same time, the share of fossil fuels in electricity generation fell to 32.5%, and coal fell to an all-time low of 12.3%[17]. The REPowerEU plan envisages that by 2030, 72% of electricity will come from RES, with wind and solar power accounting for 55%. The EU is at the forefront of RES promotion, but it is no exception. Other countries, including China and the U.S., are

16 EEA, *Share of energy consumption from renewable sources in Europe*, https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from [22.03.2024].

17 EMBER, *2023: A milestone year for renewable energy in Europe – Unveiling Ember's Electricity Review*, https://www.solarpowereurope.org/news/2023-a-milestone-year-for-renewable-energy-in-europe-unveiling-ember-s-electricity-review [24.03.2024].

also following the path of energy transition. In 2028, renewable energy sources are predicted to account for 42% of global electricity generation[18]. At the same time, a slow decline in coal-based generation is visible. The biggest increase is in solar energy due to the rapidly increasing number of photovoltaic panels and the decreasing cost of their installation and energy production[19]. The energy crisis has not brought about the return of coal and gas – quite the opposite. Coal is on the verge of phasing out, and with the development of RES, gas will be the next.

Figure 1. Share of EU electricity generation by sources in 2023



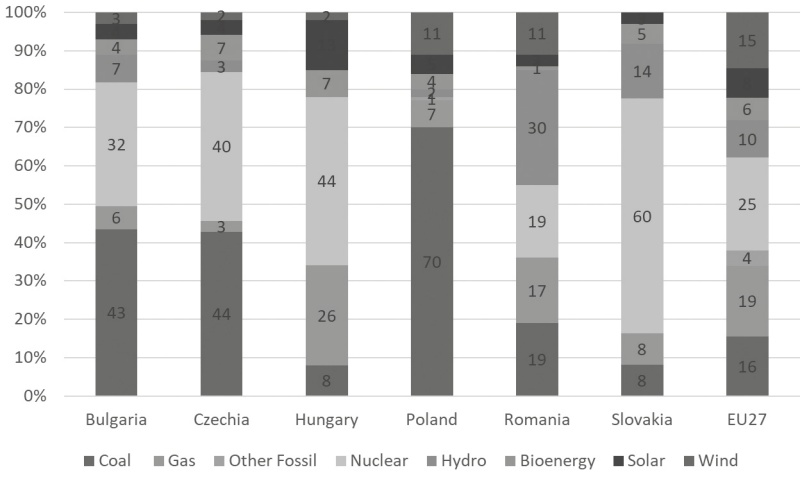
Source: own elaboration based on: https://www.iea.org/regions/europe and https://ember-climate.org/countries-and-regions/regions/european-union/.

However, not all EU countries are meeting the EU's targets for increasing the RES in electricity production. Half of the CEE countries, including Poland, Czechia, Slovakia, Hungary, Romania and Bulgaria, have started the energy transition process, but their achievements are not sufficient to ensure energy resilience. Sources of electricity generation are gradually being diversified, but the share of RES is still small. In 2022, in Bulgaria, only 18% of all electricity came from RES, in Czechia – 16%, in Hungary – 27%, in Poland – 22%, in Slo-

18 IEA, *Renewables*, https://www.iea.org/energy-system/renewables [2.04.2024].
19 IEA, *Renewables 2023. Analysis and forecasts to 2028*, https://www.iea.org/reports/renewables-2023 [2.04.2024].

vakia – 22%, while in the EU as a whole, the share of RES accounted for 39% of electricity. Only Romania stands out from the CEE countries, as the share of RES amounted to 45% due to the high production of electricity in hydro power plants[20]. The solar and wind energy promoted by the EU is underdeveloped in these countries. In Bulgaria, it accounts for only 7% of electricity, in the Czech Republic 6%, in Poland 16%, in Romania 14%, in Slovakia 8%, while in the EU as a whole, it is 23%. Only Hungary recorded a 20% share[21].

Figure 2. Electricity generation by source in selected CEE countries in 2022



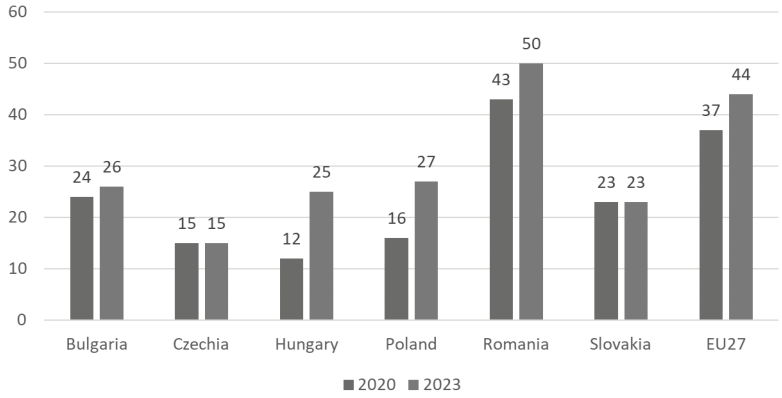
Source: own elaboration based on: https://www.iea.org/regions/europe and https://ember-climate.org/countries-and-regions/regions/european-union/.

The following year, in 2023, significant progress was made across the EU in the development of renewable energy, reaching 44% of its share in electricity production. A change can also be seen in the CEE countries. The share of RES in electricity generation increased to 50% in Romania, 27% in Poland, and 25% in Hungary. In Bulgaria, Slovakia and the Czech Republic, the increase was modest or remained at the same level.

20 IEA, *Energy system of Europe*, https://www.iea.org/regions/europe and https://ember-climate.org/countries-and-regions/regions/european-union/ [29.03.2024].

21 EMBER, *European Union. The EU accelerates electricity transition in the wake of crisis*, https://ember-climate.org/countries-and-regions/regions/european-union/ [26.03.2024].

Figure 3. Share of energy from RES in selected CEE countries in 2023



Source: own elaboration based on: https://www.iea.org/regions/europe and https://ember-climate.org/countries-and-regions/regions/european-union/.

The current share of RES in electricity generation in CEE countries is not large, but the targets agreed upon with the European Commission for 2030 are not very ambitious. A comparison of the RES targets in all EU countries shows how inadequate the energy strategies of the CEE countries are. The targets of Bulgaria, Czechia, Hungary, Poland, and Slovakia adopted in the national plans assume a 30–35% share of RES in total energy. The target for the EU as a whole is 42.5%. On the other hand, Sweden, Portugal, Denmark, Finland and Germany are aiming for a 50–80% share of RES. Plans to phase out the use of coal are also unambitious. Poland plans to phase out coal by 2049, Bulgaria by 2038, Czechia and Slovakia by 2033, Romania by 2030, and Hungary by 2025[22]. What is more, in some CEE countries, legal regulations have been introduced, which have significantly limited the development of RES (e.g. in Poland, a law was passed that introduced restrictive rules for the location of wind farms, which completely inhibited the construction of new wind investments for many years).

22 CEE, *Energy Outlook. Where do national commitments lead?*, Report, Orlen, Warsaw, January 2024, https://future.orlen.pl/content/dam/internet/future-orlen/pl/en/ORLEN_outlook_EN.pdf [23.03.2024].

3.2 Decentralisation of the energy system, expansion and modernisation of energy networks in CEE countries

The dominant energy production and transmission system in CEE is currently a centralised energy management system. It is a system in which electricity is first generated in large power plants located far away from consumers, and then transmitted and distributed to end users via electricity grids. A centralised energy system is more vulnerable to physical, military, terrorist, and cyber threats, as well as environmental and climate threats.

To enhance energy resilience, the energy system should be decentralised. A decentralised energy system is characterised by the location of energy generation and transmission companies closer to the places where it is consumed. It also allows for more optimal use of energy, including RES, reduces the use of fossil fuels, and increases environmental efficiency. The decentralised energy system is a relatively new approach in the energy sector in many countries.

Traditionally, the energy sector in CEE countries has focused on the development of large, central power plants and the transmission of energy via long transmission and distribution lines to consumers. The energy strategies of these countries envisage basing energy production on fossil sources (coal and gas) and on nuclear power. Energy obtained from RES (including solar and wind) is only to be a supplement to conventional energy[23]. This means that there are no plans to decentralise the energy systems in these countries in the near future; on the contrary, centralisation is being strengthened through new investments in the development of gas infrastructure and nuclear power plants. Even in Romania, where the RES currently accounts for 50% of the electricity produced, the main source of this energy is hydro, including large centralised hydroelectric power plants.

Large-scale energy sectors will continue to be developed in CEE countries, with state-owned energy companies being the main beneficiaries. The continuation of such a model is not conducive to enhancing energy resilience. The development of a bottom-up, distributed power generation based on RES (especially wind and solar) would most quickly bring concrete results in terms of ensuring energy resil-

23 Ibid.

ience and reducing greenhouse gas emissions. The fledgling energy transition in CEE countries is, in many cases, created from the bottom up by citizens who become producers of energy from home photovoltaic (PV) installations. An example is Poland, where households are the main producer of energy from PV systems. Over the past few years, distributed photovoltaic (prosumer) energy has been growing rapidly in Poland, and at the end of 2023, more than 1,400 million home micro-installations were connected to the grid, with a capacity of 11.4 GW[24]. However, after the introduction of a new prosumer billing system in the form of net-billing (which replaced net-metering), the dynamics of development of PV micro-installations sharply decreased. Moreover, in 2023, due to the overproduction of electricity, PSE reduced the operation of photovoltaic power plants several times to stabilise the national power system in the situation of imbalance between energy demand and supply. This is further evidence of the priority given to large conventional power plants as the backbone of a centralised energy system[25]. The current energy policy of Poland, despite the implementation of support programs for PV, is not conducive to the development of distributed prosumer energy and the decentralisation of the energy system.

One of the reasons for the inhibition of the development of distributed prosumer energy in CEE countries is also the outdated and inadequate power grid. EMBER's research shows that electricity grids across the EU are not aligned with RES development goals. Moreover, the plans for investments in energy networks are underestimated in relation to the RES investment targets[26]. This means that despite the development of energy based on RES, the energy transition may be halted by an anachronistic power grid. The biggest problem is the inadequacy of power grids to the planned PV investments. According to EMBER, in 11 of the 26 countries, the plans include 60 GW of un-

24 PTPIREE, *Micro-installations in Poland*, http://www.ptpiree.pl/energetyka-w-polsce/energetyka-w-liczbach/mikroinstalacje-w-polsce [18.03.2024].

25 P. Pająk, *Weak start of 2024 on the prosumer market*, https://www.gramwzielone.pl/energia-sloneczna/20191451/slaby-poczatek-2024-r-na-rynku-prosumenckim [19.03.2024].

26 E. Cremona, C. Rosslowe, *Putting the mission in transmission: Grids for Europe's energy transition: Some of Europe's grid development plans could fall short of what's needed for wind and solar roll out*, https://ember-climate.org/insights/research/putting-the-mission-in-transmission-grids-for-europes-energy-transition/#supporting-material [22.03.2024].

derestimated PV capacity and 27 GW in wind power. Transmission networks in CEE countries are not adapted to their energy needs for several reasons: firstly, the old grids are based on a one-way transmission of energy and were designed for large, centralised power plants and do not meet the needs of RES energy distribution. Secondly, they are outdated – more than half of the networks are over 40 years old. In Poland, 75% of the networks were established 25 years ago. Underinvestment, monopolisation, and the lack of incentives for consumers are also problems[27].

One of the elements of modernising power grids is the introduction of smart grids, which use advanced technologies to effectively manage energy distribution. In CEE countries, smart grids are being introduced, but very slowly. An example is the insufficient increase in the installation of smart energy meters. By 2024, only 5 million have been installed in Poland[28]. In Bulgaria, only 450,000 such meters are planned to be installed. Cross-border cooperation for the creation of smart grids was launched with a long delay. Only in 2022, Poland and Czechia initiated cooperation within the framework of Europe's Green and Intelligent Grid project, which aims to increase the efficiency of the power grid. The new EU Action Plan for Grids is expected to accelerate the construction and modernisation of electricity grids. This is an excellent opportunity for CEE countries to increase investments in the modernisation and expansion of transmission and distribution networks.

4. Can CEE countries strengthen their energy resilience and how?

In CEE countries, there is still a high dependence on fossil fuels, including coal and gas, which are imported from fragile regions. This dependency is exacerbated by outdated and underinvested electricity infrastructure, which creates serious obstacles to the development of the RES. Removing these bottlenecks gives CEE countries the opportunity to become leaders in cost-optimal and climate-friendly adapta-

27 CANEurope, *Future-Proofing Central Eastern European Grids for Tomorrow's Energy System*, February 2024 https://caneurope.org/central-eastern-europe-grids/ [28.03.2024].

28 T. Elżbieciak, *We already have 5 million smart meters https://wysokienapiecie.pl/96908-mamy-juz-5-mln-inteligentnych-licznikow/* [2.04.2024].

tion of energy systems. They have a huge potential for the development of energy based on RES. According to EMBER estimates, these countries could deliver 200 GW of wind and solar by 2030, and regional collaboration could open up over 100 GW of offshore wind potential[29]. The accelerated deployment of renewables can lead to improved security and lower energy prices. To achieve this, it is necessary to set ambitious wind and solar energy targets and achieve them by 2030, which will reduce electricity prices and increase competitiveness, as well as align national RES development strategies with EU policies, which will enable the mobilisation of 136 billion EUR from the Recovery and Resilience Facility, the Just Transition Fund, and the Modernisation Fund[30]. It is also necessary to strengthen cross-border cooperation in order to modernise, expand, and integrate smart grids and to eliminate legal and administrative barriers (e.g. shortening the time of issuing permits) in the development of energy based on RES.

Conclusions

The EU is treating the energy crisis as an opportunity to move away from imports of Russian energy resources and to accelerate the energy transition, thereby strengthening energy independence and resilience. This is to be achieved by increasing the use of energy from renewable sources. For CEE countries, changing the energy mix and increasing the share of RES in it is a major challenge, as their energy strategies are dominated by the belief that nuclear energy and energy from fossil fuels (coal and gas) are a guarantee of building energy security. Increasing the share of RES in electricity generation is, to a greater extent, forced by the objectives of the EU's energy and climate policy rather than the result of their national energy development strategies.

The analysis confirms the thesis that the process of strengthening energy resilience in CEE countries is progressing, but too slowly and unevenly. The basic requirements for enhancing energy resilience are not sufficiently met in these countries. The small share of energy from

29 E. Cremona, C. Rosslowe, *Putting the mission in transmission…*

30 EMBER, *In it together: the road to a cleaner, cheaper CEE power system*, https://ember-climate.org/insights/research/in-it-together-cee-power-system/#supporting-material [2.04.2024].

the RES in the energy mix, combined with the high share of fossil fuels, not only lead to high energy prices, but also make these countries dependent on imports of energy resources from often unstable regions. Unambitious plans for the development of energy production from the RES and insufficient support instruments are not conducive to increasing the pace of energy transition. In addition, the lack of modernisation and expansion of power grids inhibits the development of distributed prosumer energy. Only the energy transition that has begun and is slowly progressing is not a sufficient basis for building energy resilience. If CEE countries fail to accelerate the development of RES-based energy, they will be forced to import 34 TWh of electricity in 2030, which is a fivefold increase compared to 2022[31].

Poland could take advantage of its presidency of the EU from January 2025 and propose a plan for cross-border energy cooperation in the CEE region, as the existing cooperation is insufficient, and individual countries are trying to cope with the problem of strengthening energy resilience on their own.

References

1. Baldursson F.M., Banet C., Chyong Ch., *Building Resilience in Europe's Energy System*, CERRE, Report, June 2023.
2. CANEurope, *Future-Proofing Central Eastern European Grids for Tomorrow's Energy System*, February 2024, https://caneurope.org/central-eastern-europe-grids/.
3. CEE, *Energy Outlook. Where do national commitments lead?*, Report, Orlen, Warsaw, January 2024, https://future.orlen.pl/content/dam/internet/future-orlen/pl/en/ORLEN_outlook_EN.pdf.
4. Coaffee J., *Futureproof: How to Build Resilience in an Uncertain World*, Yale University Press, 2019.
5. Cremona E., Rosslowe C., *Putting the mission in transmission: Grids for Europe's energy transition: Some of Europe's grid development plans could fall short of what's needed for wind and solar roll out*, https://ember-climate.org/insights/research/putting-the-mission-in-transmission-grids-for-europes-energy-transition/#supporting-material.
6. EEA, *Share of energy consumption from renewable sources in Europe*, https://www.eea.europa.eu/en/analysis/indicators/share-of-energy-consumption-from.
7. Elżbieciak T., *Mamy już 5 mln inteligentnych liczników*, https://wysokienapiecie.pl/96908-mamy-juz-5-mln-inteligentnych-licznikow/.

31 Ibid.

8. EMBER, *2023: A milestone year for renewable energy in Europe – Unveiling Ember's Electricity Review*, https://www.solarpowereurope.org/news/2023-a-milestone--year-for-renewable-energy-in-europe-unveiling-ember-s-electricity-review.
9. EMBER, *European Union. The EU accelerates electricity transition in the wake of crisis*, https://ember-climate.org/countries-and-regions/regions/european--union/.
10. EMBER, *In it together: the road to a cleaner, cheaper CEE power system*, https://ember-climate.org/insights/research/in-it-together-cee-power-system/#supporting--material.
11. *EU Energy Outlook to 2060: power prices and revenues predicted for wind, solar, gas, hydrogen + more*, https://energypost.eu/eu-energy-outlook-to-2060-power--prices-and-revenues-predicted-for-wind-solar-gas-hydrogen-more/.
12. European Commission, *Communication: REPowerEU Plan*, COM(2022) 230 final, Brussels, 18 May 2022, https://energy.ec.europa.eu/system/files/2022-05/COM_2022_230_1_EN_ACT_part1_v5.pdf.
13. European Commission, *Communication: Securing our future Europe's 2040 climate target and path to climate neutrality by 2050 building a sustainable, just and prosperous society*, COM(2024) 63 final, Strasbourg, 6 February 2024.
14. European Commission, *In focus: EU energy security and gas supplies*, https://energy.ec.europa.eu/news/focus-eu-energy-security-and-gas-supplies-2024-02-15_en.
15. Eurostat, *EU trade with Russia – latest developments*, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_trade_with_Russia_-_latest_developments#Latest_developments.
16. IEA, *Energy system of Europe*, https://www.iea.org/regions/europe and https://ember-climate.org/countries-and-regions/regions/european-union/.
17. IEA, *Renewables*, https://www.iea.org/energy-system/renewables.
18. IEA, *Renewables 2023. Analysis and forecasts to 2028*, https://www.iea.org/reports/renewables-2023.
19. Jasiunas J., Lund P., Mikkola J., *Energy system resilience – A review*, "Renewable and Sustainable Energy Reviews" 2021, vol. 150.
20. Joshi P., Gokhale-Welch C., *Fundamentals of Energy Security and Resilience*, National Renewable Energy Laboratory, November 2022, https://www.nrel.gov/docs/fy23osti/84499.pdf.
21. Misiągiewicz J., *Energy security as an area of international security*, "Stosunki Międzynarodowe – International Relations" 2022, vol. 58.
22. *Number of operational, shutdown, and planned nuclear reactors in European countries*, https://www.statista.com/statistics/792589/operational-nuclear-reactors--european-union-eu-28/.
23. Pająk P., *Słaby początek 2024 r. na rynku prosumenckim*, https://www.gramwzielone.pl/energia-sloneczna/20191451/slaby-poczatek-2024-r-na-rynku-prosumenckim.
24. PTPIREE, *Mikroinstalacje w Polsce*, http://www.ptpiree.pl/energetyka-w-polsce/energetyka-w-liczbach/mikroinstalacje-w-polsce.
25. Rinaldi E., *How to strengthen energy resilience in an uncertain world*, Eurelectric, August 2023, https://www.eurelectric.org/in-detail/energy-resilience.