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# Determinants and challenges of energy security in EU countries

**Determinanty i wyzwania bezpieczeństwa energetycznego w krajach UE**

**Abstract:** The primary objective of the paper is to present threats and challenges to ensuring energy security in EU countries. Reflections on this topic were carried out using various definitions of the general concept of energy security, its determinants, and the key areas. The article is based on available studies containing analyses of energy security in EU countries against the background of its general concept described in different approaches. The study contains an analysis of different approaches to the issue of energy security with added value primarily in the presentation of the perspectives of energy security of the EU countries in the aspect of the current challenges arising from the geopolitical situation in Europe and the world, and in particular the consequences of economic crisis. In addition, attention was drawn to the characteristics of energy security as a public good. The publication presents the concept of energy security, with particular emphasis on the issue of its provision in relation to EU countries. The results achieved made it possible to define its essential determinants and scope. In addition, fundamental challenges to the EU energy security policy and ways to overcome them were formulated.
**Keywords:** energy security, EU energy security challenges, determinants energy security
**Streszczenie:** Głównym celem artykułu jest przedstawienie zagrożeń i wyzwań związanych z zapewnieniem bezpieczeństwa energetycznego w krajach UE. Refleksje na ten temat przeprowadzono z wykorzystaniem różnych definicji pojęcia bezpieczeństwa energetycznego, jego determinantów oraz kluczowych obszarów. Artykuł opiera się na dostępnych badaniach zawierających analizy bezpieczeństwa energetycznego w krajach UE na tle ogólnego pojęcia opisanego w różnych podejściach. Opracowanie zawiera analizę różnych podejść do kwestii bezpieczeństwa energetycznego, z wartością dodaną w postaci prezentacji perspektyw bezpieczeństwa energetycznego krajów UE w kontekście aktualnych wyzwań wynikających z sytuacji geopolitycznej w Europie i na świecie, a zwłaszcza konsekwencji kryzysu gospodarczego. Po-

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nadto zwrócono uwagę na charakterystykę bezpieczeństwa energetycznego jako dobra publicznego. Publikacja przedstawia koncepcję bezpieczeństwa energetycznego, ze szczególnym uwzględnieniem kwestii jego zapewnienia w odniesieniu do krajów UE.
**Słowa kluczowe:** bezpieczeństwo energetyczne, wyzwania bezpieczeństwa energetycznego UE, determinanty bezpieczeństwa energetycznego

# 1. Essence, scope, and determinants of energy security

## 1.1. Essence of the energy security concept

According to the definition contained in energy legislation, energy security is a state of the economy that makes it possible to cover the consumers' prospective demand for fuels and energy in a technically and economically justified manner, while maintaining the requirements of environmental protection. This concept is also associated with guaranteeing the security of the supply of raw materials, production, transmission, and distribution of energy, i.e. maintaining the continuity of the energy chain[1].

At its narrowest, energy security is usually synonymous with the security of supply at affordable prices[2]. This definition refers to such dimensions as geological accessibility, political accessibility, economic affordability, and infrastructure resilience. In its broadest sense, the term also includes such dimensions as environmental sustainability, social acceptability, and regulatory stability[3].

To keep it simple, Perez, Scholten, and Smith Stegen[4] follow the World Energy Council, which defined energy security as an "uninterruptible supply of energy, in terms of quantities required to meet demand at affordable prices".

1 O. Skindzier, *Od czego zależy bezpieczństwo energetyczne?*, Money.pl, 10 June 2022, www.money.pl/gospodarka/od-czego-zalezy-bezpieczenstwo-energetyczne-6778365727709888a.html [5.04.2024].

2 L. Chester, *Conceptualising energy security and making explicit its polysemic nature*, "Energy Policy" 2010, no. 38, pp. 887–895; B. Kruyt et al., *Indicators for energy security*, "Energy Policy" 2009, no. 37, pp. 2166–2181; B. Sovacool, I. Mukherjee, *Conceptualizing and measuring energy security: a synthesized approach*, "Energy" 2011, no. 36, pp. 5343–5355; C. Winzer, *Conceptualizing energy security*, "Energy Policy" 2012, no. 46, pp. 36–48.

3 B. Sovacool, I. Mukherjee, *Conceptualizing…*

4 M. de la Esperanza M. Perez, D. Scholten, K. Smith Stegen, *The multi-speed energy transition in Europe: Opportunities and challenges for EU energy security*, "Energy Strategy Reviews" 2019, vol. 26.

The definition proposed by the International Energy Agency states that energy security is the uninterrupted availability of energy sources, as well as their affordability.

Energy security is also the ability of the energy system to respond rapidly to dynamic changes related to the balance of energy supply and demand[5].

Interest in energy security is based on the assumption that an uninterrupted energy supply is crucial to the functioning of the economy. However, the exact definition of energy security (or its synonym security of supply (SOS)) is difficult to give as it has different meanings for different people at different times[6].

Traditionally, this has involved securing access to oil supplies[7] and the inevitable depletion of fossil fuels. In particular, the "oil crises" of the 1970s and 1980s resulted in dependence on Middle Eastern oil-exporting countries. As natural gas consumption increased, so did concerns about its security, extending the concept to other fuels. As oil is now a globally traded commodity, physical shortages affect the price of oil on the world market, in the form of long-term increases and short-term fluctuations[8]. As a result, SOS concepts have partly moved away from a purely physical definition of fossil fuels (used mainly by geologists) to one that also takes into account the price of energy[9] (with a particular economic aspect).

The concept and definitions of energy security have expanded over time. Contemporary definitions[10] can be distinguished on the basis

5 Ibid.

6 A.F. Alhajji, *What Is Energy Security? Definitions and concepts*, "Middle East Economic Survey" 2007, vol. 1, no. 455.

7 According to the International Energy Agency (IEA), this preoccupation with oil stems from the fact that electricity, gas, and coal were national fuels, often delivered through state-owned enterprises exercising a monopoly.

8 IEA, *Energy Security and Climate Policy: Assessing Interactions*, 2007, https://iea.blob.core.windows.net/assets/01fda85f-c396-47bf-9ef9-686e78b0a7f7/energy_security_climate_policy.pdf [15.03.2024]; M.A. Toman, *International oil security: problems and policies*, "Resources for the Future" 2002, no. 2–4, https://media.rff.org/documents/RFF-IB-02-04.pdf.

9 F. Jenny, *Energy Security: a market-oriented approach*, presentation at the OECD Forum on innovation, growth, and equity, Paris, 14–15 May 2007.

10 J.M. Chevalier, *Security of energy supply for the European Union*, "European Review of Energy Markets" 2006, vol. 1, no. 3; APERC (Asia Pacific Energy Research Centre), Institute of Energy Economics, Japan (IEEJ), *A Quest for Energy Security in the 21st century*, 2007, www.ieej.or.jp/aperc [27.03.2024]; Clingendael Institute, Clingendael International Energy Programme (CIEP), *EU Energy Supply Security and Geopolitics* (Tren/C1-06-2002), CIEP Study, 2004, http://www.clingendael.nl/publica-

of four main elements. The first and most dominant element (included in all definitions) is the availability of energy for the economy. This involves the element of absolute availability or physical existence (fossil resources are essentially infinite). Availability, due to the large spatial discrepancy between resource consumption and production, often has geopolitical implications. Finally, some definitions also include an element of environmental sustainability, e.g., related to the availability of raw materials and bioenergy.

B. Kruyt et al.[11] follow the classification scheme proposed by the Asia Pacific Energy Research Centre (APERC), classifying SOS-related elements into:

- availability – or elements related to geological existence,
- accessibility – geopolitical elements,
- affordability – economic elements,
- acceptability – or environmental and social elements.

It should be noted that these are only some of the categories that are subject to complex interactions[12].

With regard to the timeframe considered, different views of the security of energy supply can be distinguished. A distinction is often made between short-term and long-term energy security[13]. The former is concerned with (mitigating) disruptions, while the latter deals with the more structural aspects of the energy system and thus the causes of these disruptions. Although these two aspects are interlinked, underinvestment in long-term SOS leads to an increased risk of disruptions[14].

### 1.2. Scope (essential areas) for shaping energy security

It is, therefore, worthwhile, when talking about energy security, to consider action in the following areas[15]:

- diversification of supply – this provides the possibility to react appropriately in the event of supply disruptions from any one

tions/2004/ 200401000_ciep_study.pdf [29.03.2024]; IEA, *World Energy Outlook. China and India insights*, 2007, https://eneken.ieej.or.jp/en/data/pdf/412.pdf [31.03.2024].

11 B. Kruyt et al., *Indicators for energy security…*; APERC, IIEEJ, *A Quest for Energy Security…*

12 B. Kruyt et al., *Indicators for energy security…*

13 IEA, *Energy Security…*

14 IEA, *World Energy Outlook…*

15 O. Skindzier, *Od czego zależy…*

supplier, moreover, it brings with it an element of competition, which in turn can affect energy prices; dependence on a single supplier also makes a country vulnerable to political or economic pressures,

- strategic reserves – even properly diversified imports of energy raw materials do not have an immediate effect on market supplies, hence the creation of a buffer in the form of national intervention stocks and the management of these stocks is very important,
- contracts with raw material suppliers – long-term contracts for the supply of raw materials obviously have an impact on the certainty of supply, provided that partnership relations between the supplier and the customer are maintained, not only at the stage of negotiating the contract but also during its implementation,
- multilateral international agreements – taking initiatives and participating in agreements involving exporters, importers, and transit countries alike, in order to establish rules for international energy trade (e.g., the Energy Charter Treaty[16]),
- modern and secure infrastructure – reduces energy transmission losses, which is important for energy prices; resilience to threats of terrorist attacks or unpredictable natural disasters reinforces the security of supply,
- transmission networks and interconnections – are of particular importance in a market such as the EU; they offer the possibility of a solidarity-based "neighbourhood" response in the event of energy supply problems in a specific market (area),
- market liberalisation – the energy sector has a traditional tendency towards market consolidation and monopolisation; the creation of conditions for competition in the energy market has an impact on the "affordability" of prices and, consequently, on the availability of energy,
- renewable energy sources (RES) – energy obtained from wind, water, sun, or biomass is widely available; an increase in the share

16 Energy Charter Secretariat, *The International Energy Charter Consolidated Energy Charter Treaty with Related Documents*, 2015.

of RES in the energy balance obviously increases the country's independence from external supplies of conventional energy; development and popularisation of biofuels or biogas plants (installations using biomass to produce gas, heat or electricity) may be extremely important for building energy security,

- ownership policy in the energy sector – the privatisation of energy sector entities may create conditions for the development of competition, but the source of capital sometimes becomes a sensitive issue (examples include Belarus or Ukraine, which lost control of their own gas transit network to Russia's Gazprom); the "new" owner may now decide not only whether to supply gas but also under what conditions it will send it to consumers,
- energy efficiency – measures aimed at minimising energy consumption while maintaining an unobtrusive effect on the end user; this applies to areas as diverse as motor vehicle propulsion, white and brown goods, and construction technology,
- modern energy generation technologies – refers to both the implementation of highly efficient and low-emission generation technologies in the traditional energy sector and pioneering solutions in the area of RES, e.g. tidal and wave energy, hydrogen cells or photoelectric cells,
- cogeneration of electricity and heat – if this solution is applied, two types of usable energy are obtained in the same generation facility,
- carbon capture and storage – a technology that is particularly important for the renaissance of coal as an essential energy carrier, especially as its reserves within the EU are ample,
- nuclear power – while still controversial, it is a highly efficient and significantly less carbon-intensive form of energy production compared to the use of natural energy carriers.

### 1.3. Determinants of energy security

Energy security depends on a number of factors and its provision is crucial for a well-functioning state. Among its most important determinants are[17]:

17 O. Skindzier, *Od czego zależy…*

- diversification of generation capacity – which means energy production systems based on different generation technologies that have adequate capacity. The systems should ensure continuity of energy supply and keep prices at an acceptable level,
- prices – the supply of cheap energy to consumers is made possible by keeping generation, transmission, and distribution costs low. Interruption of the supply chain can have a negative impact on price levels and create real economic difficulties for countries exposed to single-source dependence,
- transport – importantly, energy should be available on demand and, therefore, its transport must be easy and secure,
- supplier concentration – if a country is dependent on a limited number of suppliers of imported fuel, the level of vulnerability and risk of hostile fuel market influence increases. Supply disruptions are also possible if a country relies on suppliers from countries with unstable political systems,
- required level of investment – investment is required to meet the foreseeable growth in energy demand. Depending on a country's capabilities, it may not be feasible to make such investments, which significantly affects energy security,
- infrastructure availability – in order to build a diverse energy mix, a country must have access to diverse energy sources which require the necessary infrastructure in technical as well as technological terms such as pipelines or transmission lines,
- expertise – without technological know-how and expertise, it is impossible to create a secure energy system and it is, therefore, necessary to have a well-developed pool of experts,
- fuel switchability – by ensuring diversity in fuel consumption, the level of energy security can be increased. The conversion of fuels, e.g., coal to gas or gas to liquid fuel, means that even in the event of fuel supply problems, consumers' energy needs can be met.

According to Mazurkiewicz[18], on the other hand, the essential factors influencing the level of energy security of a country include:

- size and diversity of the domestic fuel base,

18 J. Mazurkiewicz, *Bezpieczeństwo energetyczne Polski*, "Polityka Energetyczna" 2008, vol. 11, issue 1.

- degree of diversification and use of domestic and foreign sources of energy supply,
- technical state of supply and forms of ownership of its infrastructure,
- possibility of storing fuels, the development of national and international connections of energy systems, and internal and international economic policy.

# 2. Energy security in EU countries

## 2.1. Energy security as a public good

In economic reality, two categories of goods are distinguished – public goods and private goods. A third type of good, intermediate between the above, is also often mentioned – social goods. The classification of a particular good into one of these categories is made on the basis of an analysis of the specific characteristics that the good has. The participation of the public sector in the process of delivering the goods to the final consumers is also important. It is necessary, therefore, to look here at what characteristics constitute the essence of public goods and what distinguishes these goods from the other categories – private goods and social goods.

In the context of the functioning of the public sector in the state, public goods are of fundamental importance. These are goods which, by virtue of their physical characteristics, serve the whole of society or a local collective. Consumption of these goods is egalitarian in nature, and the use of these goods by one person does not restrict access to them by others. The benefits of using such goods are indivisible. Examples of public goods include external and internal security as well as the activities of diplomatic services.

Given the above-mentioned characteristics of public goods, it should be emphasised that their use must be free. This fact gives them the character of non-market goods. No private entity will undertake to provide them for the whole of society or a given local community. The free provision of these goods can only be undertaken by public entities, which will finance them through public tributes collected from the members of the community in question. The benefi-

ciaries of a public good cover the costs of its provision on a general retribution, i.e., by paying taxes.

## 2.2. Impact of crisis and current challenges on threatening EU energy security

AggregateEU[19] was a major EU effort to diversify energy imports away from Russian fossil fuels and successfully contributed to our security of supply in 2023[20].

In February 2022, the EU's energy sector entered uncharted territory with Russia's full-scale invasion of Ukraine and attempt to weaponize European energy imports, bringing the issue of security of energy supply to the EU into the spotlight. With almost half of the EU's gas imports coming from Russia and a large share of coal and oil, the EU faced the dual challenge of securing the security of the energy supply and keeping prices at remotely affordable levels.

Two years have passed, and the EU's energy import landscape has changed significantly. Although total gas demand was around 400 billion cubic metres (bcm[21]) per year before the war, of which only around 10% was covered by domestic production, the 150 bcm of natural gas (both LNG and pipeline) imported into the EU from Russia in 2021 almost halved (to 80 bcm) in 2022 and fell by a similar proportion (to 43 bcm) in 2023. In short, the EU's dependence on Russian gas fell from 45% in 2021 to just 15% in 2023.

This has been achieved largely thanks to the European Commission's REPowerEU plan[22], launched in May 2022, in direct response to Russia's callous actions. It aims to strengthen Europe's energy security by saving energy, accelerating the transition to clean energy, and diversifying energy import sources.

19 European Union (EU), *EU Energy Platform*, https://energy.ec.europa.eu/topics/energy-security/eu-energy-platform [7.04.2024].

20 EC (European Commission). Directorate-General for Energy (ENER), *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 [6.04.2024].

21 1 bcm of gas is equal to 678,000 tons of gas.

22 EC, *Communication from the Commission to the European Parliament, the European Council, the Council, the European Economic and Social Committee and the Committee of the Regions. Repower EU Plan*, SWD(2022) 230 final, 2022.

In the long term, EU energy security will be achieved by replacing imported fossil fuels with domestically produced renewable energy and improving energy efficiency. The EU aims to become the world's first climate-neutral continent by 2050. However, while the share of renewables in EU energy consumption is growing and has more than doubled between 2004 and 2022, natural gas still accounts for around a quarter of EU energy consumption. And the EU is still highly dependent on external suppliers of this fuel. Therefore, gas supply diversification and cooperation with reliable partners have a key role to play in ensuring the security of supply for European citizens, businesses, and essential services such as hospitals in the short to medium term, until we achieve our goal of full decarbonisation.

### 2.3. Diversifying energy supplies as a main factor strengthening Europe's position in the global energy market

The energy crisis has taught the European energy market a hard lesson. The large share of Russian oil and gas imports in Europe's energy mix has led to an over-reliance on one untrustworthy supplier.

Providing greater diversity of energy import sources means that if one is suddenly cut off, for whatever reason, the impact will be less felt. Trading with more predictable and stable energy partners greatly minimises the risk of malicious disruptions to energy supply.

A combination of more reliable pipelines and imports of liquefied natural gas (LNG) was key to overcoming the EU's dependence on Russian gas imports. As a result, Norway and the US became Europe's main gas suppliers in 2023, accounting for 30% and 19% of total gas imports, respectively.

The situation called for a rethink of the status quo in the EU energy market. Despite the EU's unquestionable appetite and need for solidarity on the issue, in the early days of the crisis, EU players inadvertently overbid each other in the global energy market in an attempt to secure supply.

In response to the EU's chaotic approach to the energy crisis, the EU Energy Platform was created on 7 April 2022 to help secure the EU's energy supply and create gradual independence from Russian gas in a coordinated manner through demand aggregation and joint purchases of natural gas.

AggregateEU was launched in 2023 to help secure adequate energy supplies for the winter of 2023–2024. It provided a channel for all gas companies based in the EU, or in Energy Community countries, to aggregate gas demand and attract supplies from international suppliers.

Four bidding rounds were organised between April and December 2023. These consisted of buyers confirming how much gas they wanted to buy and suppliers offering gas for sale. This was followed by a form of matchmaking via a platform to facilitate contracting. Indeed, during these rounds, after searching for the most competitive offers from international suppliers, AggregateEU matched over 42 bcm of gas to cover European demand.

Overall, the EU Energy Platform[23] has achieved excellent results in aggregating demand and coordinating the purchase of natural gas and has attracted strong interest from market participants. And because the energy crisis is still not over, EU energy ministers agreed on 19 December 2023 to extend the legal framework enabling AggregateEU for another year.

In 2024, AggregateEU is introducing a new concept of medium-term tenders, where buyers will be able to submit their demand for seasonal periods of six months. These tenders aim to support industrial consumers and help sellers identify buyers who may be interested in a longer trading partnership – i.e., up to five years – and the first tender will be launched on 15 February 2024.

## 3. Main challenges for the energy security of EU countries

The Energy Strategy[24] and Energy Union[25] call for secure, competitive, and sustainable energy in the European Union (EU) and set am-

23 EU, *EU Energy Platform…*

24 *Joint Communication to the European Parliament, the Council, the European Economic and Social Committee and the Committee of the Regions. EU external strategy energy engagement in a changing world*, SWD(2022) 152 final, 2022. According to this strategy, EU policies aim to deliver secure, sustainable, and affordable energy for citizens and businesses. The new EU external energy strategy reinforces the EU's engagement with partners and strengthens its climate and energy diplomacy.

25 ECEEE (European Council for an Energy Efficient Economy), *EU policies for energy efficiency, energy security, and climate change mitigation*, 2024, www.eceee.org/policy-areas/energy-union [6.04.2024]. In 2015, the European Council set out the first steps of an Energy Union, which is intended to function as an umbrella that brings together all the elements of energy policy into

bitious targets for the use of renewable energy sources. For example, by 2030, the EU should rely on renewables for 32% of its energy mix[26].

Achieving this target will require all Member States to adopt renewable energy and reduce their reliance on fossil fuels (domestic and imported). However, there are significant differences in the pace and motivation with which Member States are pursuing their energy transition. Some EU Member States are strongly promoting renewables (e.g., Germany and Denmark), while others are actively resisting (e.g., Poland). Moreover, some have a geographical advantage (e.g., Austria and Sweden), while others lack favourable conditions, funding, and expertise (e.g., Hungary and Romania). These differences reflect diverging national interests in energy security and lead to different (foreign) energy policy strategies, especially with regard to cooperation and interdependence. Some countries see renewable energy as an industrial opportunity that simultaneously diversifies their energy portfolio and mitigates GHG emissions.

In theory, there is one Energy Union, but in practice, there are 27 national interests. Due to differences in geography, natural resources, history, and political traditions, EU Member States' energy security priorities differ and influence their positions on common European initiatives[27]. Leaving aside the specificities of each country, two rough clusters of EU Member States can be identified.

a coherent, integrated approach. Now, the expression "energy efficiency first" has become common parlance. The Energy Union is based on the three long-established objectives of EU energy policy: security of supply, sustainability, and competitiveness. To reach these objectives, the Energy Union focuses on five mutually supportive dimensions:
Energy security.
The internal energy market.
Energy Efficiency.
Decarbonisation of the economy.
Research, innovation, and competitiveness.

**26** Council of the European Union, *Renewable Energy: Council Confirms Deal Reached with the European Parliament*, 2018, www.consilium.europa.eu/en/press/press-releases/2018/06/27/renewable-energy-council-confirms-deal-reached-with-the-european-parliament [2.04.2024].

**27** C. Demski et al., *National context is a key determinant of energy security concerns across Europe*, "National Energy" 2018, no. 3, pp. 882–888.

## 4. Divergent energy security paths in the EU

Two clusters of countries (blue and green) were identified[28] based on data from relevant European agencies and organisations, data collected by the EC, bibliographic analyses and consultations, and observed policy discussions in the Directorate-General for Energy (DG ENER). The two clusters were defined based on two main indicators: firstly, dependence on energy imports with a concentration of suppliers – with a focus on Russia[29], and secondly, the macroeconomic benefits of increased penetration of renewable energy – in terms of electricity prices, low-carbon patents, market shares, and turnover[30].

Countries that exemplify the blue cluster include Estonia, Latvia, Lithuania, Poland, the Czech Republic, Slovakia, Hungary, Slovenia, Croatia, Romania, Bulgaria, and Luxemburg. Rather than pursuing a significant build-up of renewable energies, these countries focus on diversifying their gas supplies in order to avoid politically motivated disruptions (and the Baltic countries additionally seek synchronisation with the Continental European Network). Four of these countries, the Czech Republic, Poland, Slovakia, and Hungary, form the Visegrad Group (V4) and have started to coordinate their negotiations (and opposition) with regard to EU renewable energy directives

28 M. de la Esperanza M. Perez, D. Scholten, K. Smith Stegen, *The multi-speed energy transition in Europe…*

29 ACER (Agency for the Cooperation of Energy Regulators), *ACER Market Monitoring Report – 2015. Annual Report on the Results of Monitoring the Internal Electricity and Natural Gas Markets in 2014*, 2016, https://www.acer.europa.eu/sites/default/files/documents/Publications/ACER_Market_Monitoring_Report_2014.pdf; EC, *Communication from the Commission to the European Parliament and the Council. European Energy Security Strategy*, SWD(2014) 330 final, 2014, https://eur-lex.europa.eu/legal-content/EN/TXT/PDF/?uri=CELEX:52014DC0330&from=EN [22.03.2024]; Eurostat, *Energy imports dependency*, 2019, http://ec.europa.eu/eurostat [22.03.2024].

30 EPO and IRENA (The European Patent Office and the International Renewable Energy Agency), *Development and Deployment of Climate Change Mitigation Technologies: Evidence to Support Policy Making*, Policy Brief, 2016, https://link.epo.org/web/Development_and_deployment_of_climate_change_mitigation_technologies-Policy_Brief_en.pdf [2.04.2024]; EurObserv'ER, *The State of Renewable Energies in Europe*, 18th EurObserv'ER Report, edition 2018, https://kib.pl/wp-content/uploads/2019/04/The_State_of_RES_in_Europe_2018_v2.pdf [1.03.2024]; EC, *Communication from the Commission to the European Parliament, the Council, the European Economic and Social Committee, the Committee of the Regions and the European Investment Bank. Second Report on the State of the Energy Union*, COM(2017) 53 final, 2017; Eurostat, *Electricity prices for household consumers – bi-annual data (from 2007 onwards)*, 2019, http://ec.europa.eu/eurostat [12.03.2024].

and EU electricity market reforms. While they acknowledge climate issues, they denounce the most ambitious 2030 climate targets as unfeasible and unrealistic and demand full respect for national competencies[31]. Greece, Cyprus, and Malta are also grouped in this cluster as they prioritise the diversification of energy sources and their routes through more interconnections. Additionally, they share the ambition of coordinating with non-EU countries in the Mediterranean region, which could increase their relevance as energy hubs and transit countries. Ireland and the UK were also included tentatively in this cluster. While Ireland boasts some successes with RES, it remains 90% import-dependent and its plans for an Irish-French interconnector predate the UK's decision to leave the EU. The UK is a challenge to this position because the effects of leaving the EU are still unclear. The UK strongly promotes renewables and is well-connected to North-West European energy markets, but Brexit sentiments and the repercussions of divorcing the EU may increase the salience of security of supply over other energy issues.

Typical countries of the green cluster are Finland, Sweden, Denmark, Germany, Austria, the Netherlands, and Belgium. These countries take the lead in promoting higher renewable energy targets and climate negotiations. They are motivated by environmental concerns and economic interests, as evidenced by their high share of European and global sustainable technology patents and clean-tech revenues[32].

In this light, it remains to be seen whether these countries will remain as enthusiastic now that increasing competition is eating away their early mover advantage. EU tariffs on Chinese solar panels might be a good indication of this. Needless to say, countries not included in this cluster also seek to benefit from the technological innovations ongoing in the Union. Yet they aim to build upon the expertise of their neighbouring countries, rather than bear the costs of innovating themselves. Several other countries are also in this cluster but

31 CEEP (Central Europe Energy Partners), *Central Europe Energy Partners' Recommendations for Trilogues on the Directive on the Promotion of the Use of Energy from Renewable Sources (RED 2)*, 2018, https://horizoneuropencpportal.eu/stakeholders/central-europe-energy-partners-ceep [11.04.2024].

32 EPO and IRENA, *Development and Deployment…*; EurObserv'ER, *The State of Renewable Energies in Europe…*; EC, *Communication from the Commission…*, 2017; Eurostat, *Electricity prices…*

do not fit as neatly as those mentioned above. France's nuclear focus puts it in a somewhat debatable position regarding renewables, but neither do supply security concerns dominate its energy policy. Spain, Portugal, and Italy clearly have the security of supply as one of their main energy priorities due to their high import dependence but are included in the green cluster because they have diversified supply and certainly regard renewable energy as an industrial opportunity. Despite these differences, all members of the green cluster share two important characteristics; they are well-connected continental EU countries and are relatively older EU Member States. Newer EU entrants and Island states seem to constitute the periphery of this centre, raising the question of whether it should not also separate Eastern Europe and Island countries into two separate clusters.

## 5. Measures to meet contemporary challenges for energy security in EU countries

The postulated measures to meet the contemporary challenges for energy security in EU countries include two spheres[33]:

### (1) Strengthen energy and industry supply chains and cooperation in Europe

- Make the energy security of the entire supply chain a priority for European energy policy, with an emphasis on regional strengths and stronger coordination between European organisations and national governments to ensure support for the transition.
- Increase Europe's capacity to extract, process, and produce raw materials and clean energy technologies, prioritising speed, innovation, industrial decarbonization, and closed-loop.
- Expand all available forms of low-carbon dispatchable energy, strengthen Europe's energy transport infrastructure, and increase market integration within the EU and with its neighbours.
- Develop tailored regional and national energy and industrial transition plans and improve coordination, guidance, and sup-

33 *Empowering Europe: Developing a Roadmap to Strategic Autonomy and a Competitive Energy Transition*, materials from discussion introducing European Initiative for Energy Security (EIES), 2023, https://pr.euractiv.com/pr/empowering-europe-developing-roadmap-strategic-autonomy-and-competitive-energy-transition [1.04.2024].

port at the EU level, particularly for countries with more limited capacity.
- Improve access to capital and reduce fragmentation by strengthening and simplifying financing mechanisms, shifting the focus to increasing production and infrastructure, and prioritising energy and industrial investment in the next EU multiannual financial framework.

**(2) Building allied global supply chains**
- Strengthen Europe's energy supply chains by creating a club with like-minded countries, emphasising clear incentives for participation in the Global South, and prioritising the implementation of new trade agreements.
- Building global technology alliances, strengthening cooperation with key clean energy technology producers, and ensuring mutual market access through initiatives such as the Clean Energy Incentives Dialogue.
- Strengthen transatlantic relations on energy security and technology cooperation, starting with technology alliances and building on successful examples such as the consensus on chip manufacturing diversification.
- Counter anti-competitive and anti-democratic behaviour by enforcing radical transparency, high human rights, and environmental standards at borders as well as establishing carbon pricing as a basis for industrial production for Europe and its partners.

## Conclusions

The paper highlights the basic aspects of energy security for EU countries in the form of its core areas, determinants, and challenges as well as its governing documents. Attention was also drawn to the consequences of the prevailing crisis. The division of EU countries into two different groups differing primarily in terms of the choice of the target model of energy sector development, conditioned by the macroeconomic situation and an unfavourable structure of the energy sector, is also presented. On this basis, the fundamental challenges for EU countries in ensuring energy security were identified, and ways of in-

fluencing a focus towards increasing it by meeting these challenges were indicated.

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