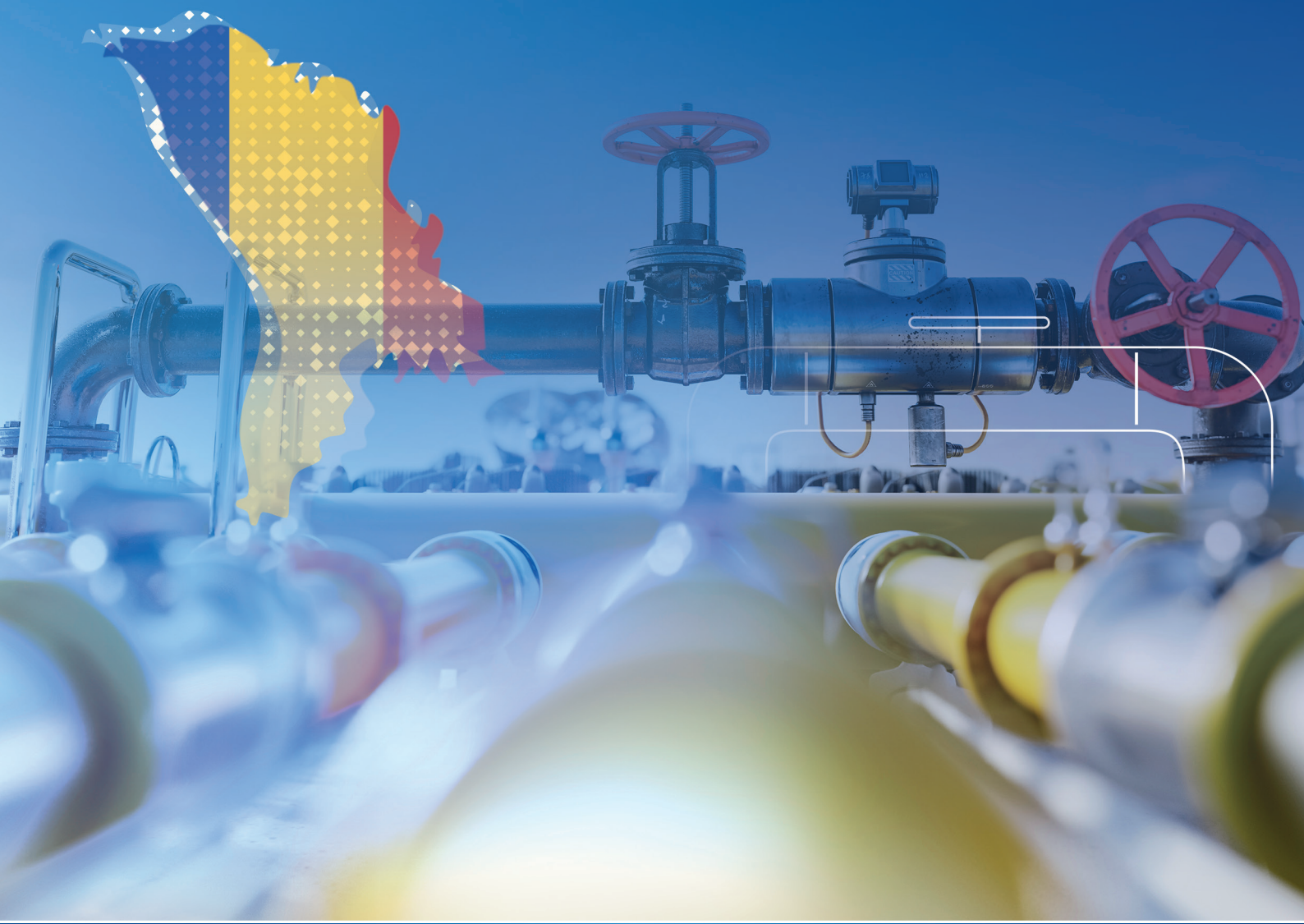
DISE ENERGY

BUILDING THE ENERGY SECURITY OF THE STATE
- SUPPORT FOR THE ENERGY SECURITY OF THE REPUBLIC OF MOLDOVA

Chisinau, Moldova 1-4 October 2024



NATO OTAN

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BUILDING THE ENERGY SECURITY OF THE STATE
- SUPPORT FOR THE ENERGY SECURITY OF THE REPUBLIC OF MOLDOVA

TRAINING MATERIALS

DISE Energy

Advanced Training Course

with support of

the NATO Science for Peace and Security

grant G6083

Chisinau, Moldova

1 – 4 October 2024

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Training organiser - DISE

The Lower Silesian Institute for Energy Studies (DISE), based in Wrocław in Poland, is a **think-tank actively involved in energy security and energy transition issues** in the strategic dimension, as well as concepts for the functioning of energy markets, business models for energy companies and industrial energy consumers, and also issues of efficiency in infrastructure projects.

DISE is made up of an **interdisciplinary group of academics and active managers** occupying key positions in major companies in the energy sector. Our experts combine theoretical knowledge and practical experience in managing the largest economic entities in Poland, which allows us to identify barriers and challenges in the Polish energy sector in a number of popular-scientific publications, analyses and opinions. DISE experts **critically analyse** the current situation in the energy market and **formulate strategic recommendations** in the form of analytical studies and comprehensive reports. The DISE team focuses in particular on **renewable energy, low-carbon energy, nuclear technology, natural gas and renewable gases**, as evidenced by the four reports published to date, carried out in cooperation with important climate and energy organisations and major Polish oil and energy companies.

We are the organiser of the annual **Energy Congress** in Wrocław, being an international and respected forum for debates among decision-makers, politicians and energy industry practitioners, which aims to jointly **develop solutions for the security and transformation of the Polish energy sector**. An important area of DISE's activity is **education**, i.e. activities aimed primarily at raising the competence of energy industry managers. Combining the knowledge and many years of experience of DISE experts with the best practices of leading foreign entities in the energy sector, we organise **study tours** to learn about the latest technical solutions in energy infrastructure facilities around the world (e.g. offshore wind farms, gas terminals or hydrogen installations). The value of the study tours is the transfer of knowledge during the seminars and learning about the latest technologies and experiences in infrastructure operation. We also provide **workshops and training** for young people to raise public awareness of renewable energy, prosumerism and responsible energy management (e.g. classes in energy clusters).

We are convinced that our activities are changing the face of the Polish energy sector for the better and initiating desirable legal changes for energy investments with future generations in mind.

www.dise.org.pl

Training experts

Dr Jerzy Baehr

Attorney-at-law, co-founder and a partner at WKB Lawyers, co-heads the energy team. Jerzy has implemented hundreds of projects for leaders in the energy sector. He was often engaged in parliamentary works on regulations crucial to the energy sector. He has co-authored acclaimed commentaries on energy law. Jerzy is highly recognised by leading worldwide and Polish legal rankings (Chambers Europe - Band 1, The Legal 500 EMEA - Hall of Fame).

Dr Piotr Dziadzio

Dr Piotr Dziadzio received his MSc in Geology (1992) from the Jagiellonian University, and a PhD (1999) in Earth Science from the Polish Geological Institute. He also graduated from National Louis University, School of Business in Nowy Sącz (2001) in the field of business management. In his career he worked for the Polish Academy of Sciences - Institute of Geological Sciences, Polish Oil and Gas Company, Rock Tools and Drilling Rigs (Glinik), private companies focusing on hydrocarbon exploration and production and currently at Oil and Gas Institute - National Research Institute in Krakow. In 2019, he was appointed Secretary of State at the Ministry of the Environment - Chief National Geologist, and then (2020-2023), Undersecretary of State - Chief National Geologist and Government Plenipotentiary for State Raw Materials Policy at the Ministry of Climate and Environment. He has a wide knowledge in the field of petroleum geology, management and public administration. He has been involved in the oil and gas industry since 1993. He has also held many positions in industry social organizations.

Maciej Kowalczyk

A graduate of the Faculty of Law and Administration of the University of Lodz and the Pushkin Institute in Moscow. For many years he was involved in providing strategic information for the development of the commercial real estate and retail sectors in Europe and Asia. From 2019 to 2024 employed at the Embassy of the Republic of Poland in Chisinau, where he was responsible for economic, development and cultural cooperation. He also served as a consul. He is fluent in English, Russian and German. He has a basic knowledge of Romanian. Former Polish Champion and medallist of the Norwegian Track Cycling Championships.

Dominik Jankowski

Dominik P. Jankowski, Polish security policy expert, diplomat, and think-tanker. He currently serves as Deputy Permanent Representative of Poland to NATO. He previously served as Policy Adviser at the Office of the NATO Secretary General Jens Stoltenberg, where he was responsible, *inter alia*, for energy security.

Dariusz Kryczka

A partner at EY Law, Poland in the field of Energy and Sustainability Practice. He graduated from Law and Political Sciences from the University of Silesia and studied at the University of Florence on one-year LLP/Erasmus fellowship. He also completed postgraduate studies in European Energy Trading at the Warsaw School of Economics and graduated from the Academy of Young Diplomats at the European Academy of Diplomacy. Dariusz holds a certificate of AgilePM® Foundation Examination, TSPM™ TenStep Project Manager Certification. Prince 2 Practitioner Examination and Prince 2 Foundation Examination.

Dr Marcin Sienkiewicz

Research fellow at the Institute of International Studies, University of Wrocław. President of the Board of the Lower Silesian Institute of Energy Studies in 2016-2018. Expert of the Eastern Policy Forum. Lecturer of the postgraduate course: Contemporary Issues in the Design, Construction and Operation of Gas Pipeline Systems at Wrocław University of Technology. Columnist for *Wiadomości Naftowe i Gazownicze* (a monthly magazine published by the Scientific and Technical Association of Engineers and Technicians of the Oil and Gas Industry) and *Przeglad Gazowniczy* (a magazine published by the Gas Industry Chamber of Commerce). Between 2008 and 2010, expert cooperation in the field of national and energy security with the Office of National Security and the Chancellery of the President of the Republic of Poland. In years 2013 - 2014, intern at the Office of Studies and Projects of the Gas Industry at GAZOPROJEKT S.A. Author of the conceptual study dedicated to the creation of a gas hub in Poland. Participant and co-organiser of numerous conferences on energy issues. Author of more than a hundred scientific publications and expert studies on energy security, energy policy of modern states, functioning of international energy markets. Since 2015, he has been working at the Polish Power Exchange S.A., currently at the position of Management Board Advisor for the Gas Market.

Zuzanna Nowak

Director of Analysis at the Opportunity Institute for Foreign Affairs and analyst of energy and climate policy. Expert at the Ignacy Łukasiewicz Energy Policy Institute in Rzeszów. Previously, she worked at the Polish Institute of International Affairs (PISM) in the Global Affairs, and earlier headed the Energy Project at PISM. She also held managerial, analytical and expert positions (especially in the field of international energy cooperation) at, among others, the Polish Oil and Gas Company (PGNiG), the National Centre for Nuclear Research (NCBJ) and the Polish Committee of the World Energy Council (PK ŚRE). She graduated from the Paris School of International Affairs, Sciences Po, and the College of Europe in Bruges. Her research focuses mainly on problems related to energy security, protection of critical infrastructure and issues of multilateral climate diplomacy.

Dr Agata Romanowska

Urban planner and spatial sustainability expert, project manager at DISE Energy. Author of research on urban sustainability and urban scale of light pollution. Populariser of knowledge on rational lighting and energy efficiency in urban planning. Professionally involved in the energy sector and energy transition issues. Member of the Planning, Law and Property Rights Academic Association and the International Dark-Sky Association.

Dr Witold Skomra

Expert in the field of national security, crisis management, risk analysis and critical infrastructure protection. Adviser to the Government Centre for Security (GCS), head of the Critical Infrastructure Protection Unit, national delegate to the EU PROCIV CER group preparing a draft Critical Entities Resilience Directive (CER Directive). Apart from his work in the GCS he is an academic lecturer at the Warsaw University of Technology. Former fire-fighter, Commander- in-Chief of the State Fire Service.

Pawel Turowski

Government and civil servant with many years of experience. He has worked in a number of central government structures, in ministries and in the Prime Minister's Office. He has worked in the National Security Office since 2007, currently in the Department of Homeland Security. He works on challenges to resilience and non-military security in the energy security sector, as well as hybrid, asymmetric, disinformation threats, and the like. He deals with geo-economic challenges to national security. He served on teams preparing two National Security Strategies (2015 and 2020) and on a team preparing the Recommendations for the 2024 National Security Strategy. He is an appointed civil servant. Participant of many NATO courses and training sessions on internal security and resilience. NATO expert on energy security. Author of numerous scientific publications on energy security, resilience, the impact of Russia's military aggression against Ukraine on the security of Central European countries. Academic lecturer.

Training programme

BUILDING THE ENERGY SECURITY OF THE STATE
- SUPPORT FOR THE ENERGY SECURITY OF THE REPUBLIC OF MOLDOVA

Chisinau, Moldova

2-3 October 2024

Day 1

2.10.2024

Training: THE ESSENCE AND IMPORTANCE OF ENERGY SECURITY

Moderator: Maciej Kowalczyk

Location: Center for Development and Entrepreneurship Poland-Moldova
Str. Mesterul Manole 12/2, et. 3.

	TOPIC	SPEAKER
09:30 - 10:30	**Welcome speeches** **Presentation of the training agenda**	H.E. **Tomasz Kobzdej**, Ambassador of Poland in the Republic of Moldova **Marcin Sienkiewicz**, DISE
10:30 - 11:00	**Energy security and sources of threats to the energy economy**	**Zuzanna Nowak**, DISE
11:00 - 11:30	**NATO and energy security**	**Dominik Jankowski**, Permanent Delegation of Poland to NATO
11-30 - 12:00	**REPowerEU - the new EU energy security strategy**	**Agata Romanowska**, DISE
12:00 - 12:15	Coffee break	
12:15 - 12:45	**The importance of energy infrastructure for state security**	**Paweł Turowski**, National Security Bureau
12:45 - 13:15	**Protection of energy infrastructure in the context of terrorist threats**	**Witold Skomra**, Government Centre for Security
13:15 - 14:00	**Open discussion**	
14:00 - 15:00	Lunch	

Day 2

3.10.2024

Training: NATURAL GAS MARKET SECURITY

Moderator: Maciej Kowalczyk

Location: Center for Development and Entrepreneurship Poland-Moldova

Str. Mesterul Manole 12/2, et. 3.

	TOPIC	SPEAKER
10:00 - 10:30	**NATO's energy security agenda**	**Julijus Grubliauskas**, NATO HQ
10:30 - 11:00	**The role of gas storage in maintaining energy security**	**Piotr Dziadzio**, Oil and Gas Institute
11:00 - 11:30	**Gas exchange and the security of gas fuel trading**	**Marcin Sienkiewicz,** DISE
11:30 - 11:45	Coffee break	
11:45 - 12:15	**EU standards for identifying and monitoring threats to energy security**	**Jerzy Baehr**, WKB Lawyers
12:15 - 12:45	**LNG infrastructure in Europe**	**Dariusz Kryczka**, EY
12:45 - 13:15	**Open discussion**	
13:15 - 13:30	**Closing remarks**	**Marcin Sienkiewicz**, DISE
13:30 - 14.30	Lunch	

Training content

1. Energy security and sources of threats to the energy economy

Zuzanna Nowak

Fossil fuels such as coal, oil and natural gas are an integral part of the energy economy and are the main sources of energy used in electricity generation, transport, industry and residential services. However, a growing number of international organisations, countries and energy market regulators are calling for a shift away from fossil fuels and towards a net-zero emissions economy by around 2050. This direction is a response to the climate crisis, but there are many difficulties in achieving the individual goals of green energy policy, primarily related to ensuring energy security.

Defining energy security

According to the most common definition formulated by the International Energy Agency, energy security is the uninterrupted availability of energy sources at an affordable price.[1] However, the concept has many additional aspects that make it still lacking a single, unambiguous, complete and generally accepted definition. Often, when defining energy security, in addition to the physical availability of raw materials and energy carriers and their price, social aspects (such as the distinction between industrial and individual consumer categories, social justice), economic aspects (e.g. the pursuit of sustainable development) and environmental aspects (e.g. the selection of technologies with zero or low environmental impact) are also mentioned.

Also, within the European Union, although energy security is one of the most discussed topics among its 27 members, it is still difficult to find a nuanced consensus on its definition. This is due, among other things, to the fact that Member States retain the right to determine the conditions under which they will exploit their energy resources, to choose which energy sources they will use and to determine their overall energy supply structure (Article 194(2) TFEU), thereby defining their energy policy priorities. It can also be observed that with the development of the European climate policy, as well as increasing concerns about maintaining the competitiveness of the European economy, the perception of energy security at the EU institutional level is changing.

Challenges to energy security

The realisation of the EU countries' decarbonisation ambitions and the drive towards self-sufficiency, which translates into increasing the share of RES in the European energy mix, carries the risk of an insufficiently flexible energy system. A too rapid phasing out of conventional energy sources such as coal-fired power plants in favour of RES (characterised by variability), without the simultaneous development of energy storage systems and transmission networks, may result in problems with security of supply. In Germany, for example, despite a significant share of RES, stable sources such as gas and coal are still required to offset the shortfall in renewable energy production. At the same time, the EU's ambitious climate policy affects the competitiveness of the European economy, which is already sensitive (due to its import dependency) to fluctuations in global commodity prices and thus their availability.

The global geopolitical and geo-economic situation is therefore not insignificant in shaping perceptions of energy security. In the wake of the 2021/2022 energy crisis, the consequences of Russia's full-scale aggression against Ukraine (including the introduction of a sanctions regime), and global competition for raw materials, greater attention has begun to be paid to specific types of

[1] IEA, *World Energy Outlook 2022, Energy security in energy transitions*, https://www.iea.org/reports/world-energy-outlook-2022/energy-security-in-energy-transitions.

threats. Physical disruptions to supply can result from infrastructure failures, acts of terrorism, natural disasters or political action, among other things. The attack on the Nord Stream pipeline in 2022 was an example of infrastructure sabotage that led to a reduction in gas supplies to Europe, raising concerns about energy security in the region. The potential damage to pipelines, power plants or other key facilities, is becoming an increasingly important element in the energy security debate, especially in high-risk regions such as the Baltic Sea region.

The next issue is the long-term physical availability of supplies of raw materials and energy carriers, as well as critical technologies and raw materials, to meet increasing energy demands in the future. The EU's increasing dependence on imports of raw materials from third countries (e.g. Chinese components for the RES development), raises questions about the long-term security of energy supply during the implementation of the European energy transition.

On the other hand, energy shortages and rapidly fluctuating prices have a negative destabilising impact on economic activity and the functioning of society. The 2022 price shock has caused serious problems for energy-intensive industries and has also significantly increased the cost of living for European citizens (thus increasing the problem of energy poverty).

The complexity of energy security threats in the face of the energy transition and a dynamically changing geopolitical environment requires a thoughtful multidimensional approach that is able to balance climate goals with economic needs and stability of energy supply.

2. NATO and energy security

Dominik Jankowski

NATO is currently focusing on four key areas in enhancing allied energy security: learning the lessons of the Russian aggression against Ukraine on energy security and continuing to support Ukraine; protecting undersea critical infrastructure, including energy; energy transition in the armed forces; and security of fuel supply for the armed forces.

Lessons from the Russian aggression and support for Ukraine

Within the first area, NATO is focusing on three elements. Firstly, massive Russian attacks on Ukraine's energy infrastructure, aimed at leading to, among other things, a reduction in civilian support for military operations and Ukraine's economic collapse, have caused NATO to closely analyse Russian actions. The analyses aim to better understand trends in Russian missile and cyber-attacks and to develop response models, including the preparation of military assets to better secure critical energy infrastructure. Ultimately, the recommendations developed as part of the response models should become part of the civil-military work in individual allied states.

Secondly, Russian aggression highlighted the still existing dependence in some NATO countries on Russian fuels for use by the armed forces. In 2023, the allies agreed on recommendations to become independent of these supplies.

Thirdly, NATO continues to support Ukraine in the sphere of energy security. Since 2022, the *NATO Support and Procurement Agency* (NSPA) has been supplying the Ukrainian armed forces with fuel. In addition, the allies have also agreed additional packages for Ukraine's energy sector under the *Comprehensive Assistance Package* (CAP). NATO, in close coordination with Poland and the United

States, is also organising specialised training for Ukrainian representatives on energy security. Ultimately, energy security training will be able to take place regularly at the NATO-Ukraine *Joint Analysis, Training, and* Education *Center* (JATEC), currently under construction in Poland.

Undersea energy infrastructure

The destruction of the Nord Stream 1 and Nord Stream 2 pipelines, as well as other sabotage activities targeting the allies' undersea energy infrastructure in the Baltic Sea region in particular, in recent months, has prompted NATO to intensify coordination between the allies in this area.

At the 2023 NATO summit in Vilnius, the allies stressed that even if the protection of critical infrastructure remains a national prerogative, NATO should be ready to support the efforts of individual countries. NATO decided to establish a Maritime Security Centre for Underwater Critical Infrastructure within NATO Maritime Command (MARCOM). An allied network for the exchange of information and experience (*Critical Undersea Infrastructure Network*) was also established in 2024, with representatives from government, the armed forces and the private sector, including infrastructure operators.

Protection of undersea energy infrastructure is also the subject of cooperation between NATO and the European Union. In 2023, the NATO-EU Task Force on Critical Infrastructure Resilience agreed on a report that also includes recommendations on energy issues and undersea infrastructure.[2]

Energy transition in the armed forces

At the NATO summit in Vilnius, the allies agreed on a new initiative for energy transition in the armed forces: *Energy Transition by Design*. The aim of the initiative is to provide a policy framework for the allies to coordinate national efforts, while maintaining the critical interoperability of the armed forces for deterrence and defence policy.

As part of its 2024 work, the Allies used the *Energy Transition by Design* initiative to discuss national energy transition plans and strategies, with a focus on the military dimension, a better understanding of the perspective of regulatory institutions and industry, and the technology dimension of energy transition, including the role of NATO's DIANA (*Defence Innovation Accelerator for the North Atlantic*).

The Allies have identified key challenges to energy transformation in the armed forces, which include ensuring interoperability, cost, security of critical infrastructure, existing dependencies within supply chains and the ability to absorb modern technological solutions. Opportunities, in turn, are seen in increasing energy efficiency, resilience and reducing the environmental impact of the armed forces.

Security of fuel supply to the armed forces

NATO's stable logistics and fuel system is based on a multi-modal approach. An important pillar of it is the *NATO Pipeline System* (NPS), which the Alliance started building as early as the 1950s. In the current security environment, the NPS plays a key role in stabilising the logistics-fuel system for at least three reasons.

Firstly, from a military perspective, the NPS has repeatedly proven its effectiveness and reliability on the occasion of NATO military operations. Now, with Russian aggression in Ukraine and a return to the concept of advanced defence, the Alliance needs reliable access to fuels that will be in constant demand. A properly adapted NPS provides a guarantee of credibility, including in a collective defence situation. Of course, strengthening NATO's eastern flank will require the expansion of the allied pipeline system also to countries in the region, including Poland. Work on expanding the NPS to Poland and other eastern flank countries has been underway since 2019. At the NATO summit in Vilnius, it was decided that the work would continue, with a particular focus on the military and financial

[2] *NATO-EU Task Force on the Resilience of Critical Infrastructure Final Assessment Report*, 29 June 2022, https://www.nato.int/nato_static_fl2014/assets/pdf/2023/6/pdf/EU-NATO_Final_Assessment_Report_Digital.pdf.

dimensions of the potential expansion project, due to the significant negative change in the security environment and growing logistical challenges on NATO's eastern flank.

Secondly, from an economic perspective, the NPS also serves the civilian market. In peacetime, it supplies fuel to Frankfurt, Amsterdam and Brussels airports, among others. The commercial use of the system helps to fulfil maintenance and repair requirements, and helps to ensure better trained and competent system operators. In addition, the revenue generated contributes to lower operating costs. Of course, NATO retains a most favoured nation clause for the use of the system in a crisis or war situation.

Thirdly, from an environmental perspective, transporting fuels via pipelines is greener than using rail, water or road solutions. Pipelines reduce greenhouse gas emissions by 61-77% compared to transporting fuels by rail. In practical terms, this means that the use of NPS contributes to the Alliance's reduction in greenhouse gas emissions.

The text represents solely the personal views of the author.

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3. REPowerEU - the new EU energy security strategy

Agata Romanowska

Decarbonisation megatrend

Europe's ambitious decarbonisation plans are included in a climate and energy policy called the Green Deal, which is being implemented through, among other things, the 'Ready for 55' legislative package. Their objectives are for the European Union to reduce net greenhouse gas emissions by at least 55% by 2030 and achieve climate neutrality by 2050.[3]

The EU economies' plans to green the energy sector and move towards climate neutrality have been revised in recent years by a massive energy crisis. It was caused first by the situation of a global pandemic and economic weakness in 2019 and then by Russia's attack on Ukraine in 2022. It was then that energy became one of the most important pillars for the functioning of modern society, especially in the era of increasing electrification as well as unstable electricity prices and supplies. Access to raw materials and the use of energy infrastructure have become the subject of blackmail against EU member states.

Highlights of the plan to strengthen energy resilience

The REPowerEU plan is the EU's strategy to reduce the Community's dependence on Russian fossil fuels and accelerate the environmental transition. It was launched in May 2022[4]. The phasing out of Russian fuels (primarily imports of Russian gas, oil and coal) simultaneously supports the following objectives:

- saving energy and improving energy efficiency,
- diversifying energy supply,
- clean energy production.

The implementation of the strategy by the Member States is done by extending the so-called national recovery and resilience plans with the REPowerEU chapter. The plans are assessed by the European

[3] Council of the European Union, "Fit for 55", https://www.consilium.europa.eu/pl/policies/green-deal/fit-for-55/.
[4] European Commission, REPowerEU, https://commission.europa.eu/publications/key-documents-repowereu_en.

Commission and approved by a Council body, and financing or loan agreements are then signed. Priority is given to investments targeting the above objectives, which can be implemented in a relatively short period of time.

It is assumed that these reforms should focus on:

- improving energy infrastructure and installations in order to meet the most pressing security of supply needs for natural gas, notably to enable diversification of supply in the interests of the EU as a whole,
- increasing the production and use of sustainable biomethane and clean or renewable hydrogen,
- increasing the share and accelerating the spread of renewable energy,
- removing internal and cross-border bottlenecks in energy transmission and distribution,
- decarbonisation of industry,
- encouraging a reduction in energy demand,
- increasing the energy efficiency of buildings,
- combating energy poverty,
- supporting zero-emission transport and its infrastructure,
- supporting energy storage.

Achieved strategy objectives

Two years after the introduction of the REPowerEU plan, the EU's energy situation is stabilising and it is possible to assess the effectiveness of measures to support the building of energy resilience and independence[5]. During this time, it has been possible, among other things, to reduce the demand for natural gas by 18% (125 bcm) and to reduce the share of Russian gas from 45% to just 15%, and also to fill the gas storage facilities of the Member States by a total of up to 95%. At the same time, for the first time ever, half of the EU's energy comes from renewable sources and the share of wind power has overtaken that of natural gas in the European mix.

Despite promising prospects, many issues remain problematic, including the need for further work on energy saving and increasing energy efficiency. There is also much to be done in the areas of energy poverty, heating appliances and energy modernisation of buildings. Above all, an effort is needed on energy policies that have the potential to become a determinant of economic competitiveness and a guarantor of energy security.

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4. The importance of energy infrastructure for state security

Pawel Turowski

NATO member states are treaty-bound to strengthen their resilience. Such a disposition follows directly from the provisions of Article 3 of the Washington Treaty. In this view, the construction of an effective system for the protection of critical infrastructure ensuring uninterrupted energy supply is a key element of the state's resilience system, which, in combination with the other subsystems responsible for, *inter alia,* continuity of governance, uninterrupted functioning of transport,

[5] European Commission, State of the Energy Union Report 2023, https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2023%3A650%3AFIN&qid=1698237100377.

communications, food and drinking water systems, forms the foundation of the national security system in the non-military sector.

NATO is an organisation focused on military defence objectives. Its budget for infrastructure investment is limited, it lacks implementation tools for enforcing resilience activities. The European Union, on the other hand, has extensive competences and financial resources to implement resilience-enhancing activities. For these reasons, NATO has entered into a number of agreements with the European Union targeting EU implementation of resilience enhancement tasks. In 2023, a Declaration of Cooperation was signed and a Joint Task Force on Critical Infrastructure Resilience was established.

EU and NATO decisions are changing the approach to critical infrastructure, shifting the focus from protection to resilience leading to an approach to threats to infrastructure equivalent to traditional threats. It is necessary to recognise the protection of critical infrastructure, including energy infrastructure, as a process focused on protecting the continuity of service provision and the need to restore it when necessary.

The question must be asked: why should the critical infrastructure protection system, and more broadly the system for strengthening state resilience, be designed on the matrix of Article 3 of the Washington Treaty, of which the NATO system is a model? The answer is brought by reality. Many major crisis phenomena, besides the well-known ones - resulting from natural phenomena, weather, or due to human error - will be generated by the state actor or its intermediaries. For these reasons, resilience from the state actor is strengthened. The strategic objective of such actions is the political destabilisation of the state using instruments belonging to the crisis sphere.

The Russian military aggression against Ukraine, has led to profound changes in the security environment of all countries in the Central and Eastern European region, the Balkans and Scandinavia. As a consequence, the security of the entire region has deteriorated profoundly.

One of the goals of the Russian Federation is to destabilise the region of Central and Eastern Europe, the Balkans and Scandinavia. The countries located in this region are the hinterland for Ukraine. Directly bordering Ukraine are: Moldova, Romania, Hungary, Slovakia and Poland. The most important transport routes to Ukraine run through many of the countries mentioned. Their operation is essential for the functioning of Ukraine.

One of the key instruments used by Russia to provoke crises inside other states is so-called hybrid actions. Hybrid actions involve the intentional generation of crises in more than one domain of influence, e.g. they can lead to energy supply disruptions which can cause panic. If disinformation activities are included, a state of tension, panic and social discontent can be created leading directly to demonstrations and political crisis.

Hybrid actions are always conducted below the threshold of regular war and by active means. They lead to the political weakening of democratic states. There is a very high probability that in the Central and Eastern European region and the Balkans the Russian Federation will use the energy infrastructure to carry out hybrid actions. In this sector, the Russian Federation has major advantages, which creates a natural base for such actions.

Many of these actions against the energy sector can be foreseen today. The greatest threat to Central and Eastern European and Scandinavian infrastructure is kinetic actions such as acts of terrorism, sabotage or attacks using flying and floating drones - leading to its physical destruction. In the case of kinetic threats, preventive actions aimed at counteracting such events by expanding physical protection and defence capabilities and shortening the time to restore full functionality will be very important.

Cyberattacks on industrial automation systems, which control all network equipment in the energy transmission and distribution sector, are to be expected. A successful cyberattack or physical attack

on Industrial Control Systems (ICS) or networks, can disrupt operations or paralyse service provision for a long time.

The Ukrainian experience shows that in addition to the necessary strengthening of the security of continuity of services in the energy sector, it is also necessary to build an effective system for the supply of spare parts of key elements of the transmission infrastructure. These include transformer stations, generators, thousands of kilometres of cables, compressor stations for natural gas and spare parts for the district heating system in large cities.

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5. Protection of energy infrastructure in the context of terrorist threats

Witold Skomra

Introduction

The energy sector in Europe is a critical infrastructure that has increasingly become a target for terrorist activities. These threats come in various forms, including physical attacks, cyberattacks and hybrid threats that combine both physical and cyber elements. The ongoing geopolitical tensions, particularly the war in Ukraine, have exacerbated these threats, making the energy sector more vulnerable than ever. The geopolitical context plays a significant role in shaping the threat landscape for the energy sector in Europe. The war in Ukraine has created a volatile environment where energy infrastructure is a prime target for both physical and cyberattacks. The European Union has taken steps to enhance the resilience of its energy infrastructure, but the ongoing conflict continues to pose significant risks.

Russia's use of energy as a geopolitical tool has further complicated the situation. The curtailment of natural gas supplies, combined with cyberattacks on energy infrastructure, has created a precarious situation for European countries. The EU has responded by diversifying its energy sources and increasing its strategic reserves, but the threat remains[6].

In the opinion of the Polish National Security Agency, we currently identify the greatest risks for infrastructure:

1. **Energy, i.e.:**

a) system power plants,
b) operation of the National Electricity System (transmission networks),
c) refineries,
d) fuel offloading at the borders (crude oil, LPG and liquefied LNG).

2. **Transport, i.e.:**

a) rail and road transport with energy resources,
b) rail and road transport with military aid to Ukraine,
c) air transport - threats to civilian and military airports carrying out tasks in support of Ukraine,
d) logistics centres involved in humanitarian aid to Ukraine.

3. **Information and communication technology, i.e.:**

[6] World Economic Forum, *Why the energy sector's latest cyberattack in Europe matters*, https://www.weforum.org/agenda/2022/02/cyberattack-amsterdam-rotterdam-antwerp-energy-sector/.

a) operation of central government systems and records,
b) disruption or interruption of industrial (OT) systems,
c) attack on financial exchanges and banks - paralysis of the state's financial system.

Methods of attacks

Methods and tools used by actors in the international arena can be very different, tailored to technical and financial capabilities, with terrorist actions being one of the elements of hybrid actions, i.e.:

1. Conducting reconnaissance activities against critical infrastructure located within a country and in neighbouring countries (if an incident can have a domino effect).
2. Identifying of vulnerabilities whose damage will trigger at least a major incident.
3. Selecting the form of attack on the CI or on the service provider for the CI operator, goods or equipment - kinetic or cyber.
4. Using flammable materials or IEDs that can be developed at home, using substances and components that are commonly available, also activated remotely.
5. Conducting cyberattacks on ICT resources, mainly targeting the control of industrial automation, e.g. waterworks, and carried out by specialised hacker groups. Vectors of attacks are also entities that manage personal data and loss of image can cause social unrest.
6. Conducting radio warfare using high-powered devices to jam civilian and military communications and radiolocation systems, e.g. mainly spoofing and jamming GNSS signals.
7. Sudden unannounced training at border training grounds, usually accompanied by strong electronic warfare components.
8. Actions and attempts to buy out an entire entity (or part of its capital) in order to achieve manual control of an entity that, for example, affects state security or is an important part of the supply chain[7].

Mitigation measures

To address these threats, European countries and energy companies are implementing a range of mitigation measures. These include:

1. Enhanced Cybersecurity: Investing in advanced cybersecurity measures to protect critical infrastructure from cyberattacks. This includes the use of artificial intelligence and machine learning to detect and respond to threats in real-time.
2. Physical Security: Strengthening the physical security of energy facilities, including the use of surveillance systems, access controls and security personnel.
3. Resilience Planning: Developing comprehensive resilience plans that address both physical and cyber threats. This includes regular drills and exercises to test the effectiveness of these plans.
4. International Cooperation: Collaborating with international partners to share information and best practices. This includes participation in initiatives such as the European Energy Security Strategy and the NATO Cooperative Cyber Defence Centre of Excellence.
5. Legislative Measures: Implementing new legislation to enhance the protection of critical infrastructure. The EU has introduced several directives aimed at improving the resilience of energy infrastructure and ensuring a coordinated response to threats[8].

[7] Threats of a terrorist nature in the Republic of Poland in 2021-2022; DOI: 10.13140/RG.2.2.26241.63840.
[8] World Economic Forum, Europe is bolstering energy sector resilience. But cyber risk remains a major vulnerability, https://www.weforum.org/agenda/2022/10/europe-is-energy-sector-resilience-cyber-risk/

6. 2021-2022 gas crisis in Europe

Zuzanna Nowak

The winter season of 2021/2022 presented itself as a difficult period for the EU. The recovery of global economies after the Covid-19 pandemic triggered commodity deficits in the markets, intensified by the shutdown of export infrastructure (including planned repairs and natural disasters at leading gas exporters). In addition, the European energy market was under pressure from Russia, which intentionally fuelled the crisis by manipulating gas supplies, prices and stocks. All this disrupted the supply chains of many companies and negatively affected the availability of raw materials and energy carriers for European citizens. Although, since the gas crises, some Central and Eastern European countries, led by Poland, have emphasised the need to reduce their import dependence on Russia, it was not until the country's full-scale aggression against Ukraine on 24 February 2022 that the taboo of the need to reduce Russian energy influence in the EU as soon as possible and redefine energy security became symbolic.[9]

The EU's vulnerabilities

The EU's vulnerability to the impact of these events was due to the widespread use of gas in the European economy as a transitional fuel in the energy transition, the assumption of free movement of this resource between individual Member States based on a liberalised market and, above all, the high dependence on fuel imports from external suppliers.[10] In the face of Russia's actions and broader geopolitical conditions, demand-supply mechanisms and attempts over the years to build resilience in the liberalised EU gas market (e.g. reflection on joint gas purchases, creation of solidarity mechanisms, intensification of LNG imports) have proved insufficient to ensure energy security. The highest gas price levels in a dozen years were recorded (in the Dutch TTF reference hub for Europe, nearly €300 per MWh at the height of the crisis). Despite the fact that at the time the EU derived only 20% of its electricity from gas, due to the structure of the market (in many countries, the price of gas-fired electricity defines the marginal price of electricity) and the unavailability of alternative energy sources, record gas prices had a dramatic impact on the condition of the entire European economy.

Rapid adaptation

The issue of ensuring the continuity of supplies of energy raw materials (especially gas) and the real diversification of the directions of their imports was reflected in quickly and efficiently adopted documents (e.g. REPowerEU), organisational solutions (e.g. the creation of a platform for joint gas purchases) and infrastructure initiatives of Member States (e.g. the construction of LNG import infrastructure in Germany). It was also necessary for Member States to implement crisis mitigation instruments - e.g. statutory price regulation, taxes on excess profits of energy companies, support for vulnerable consumers, etc.). The role of gas as a transitional fuel in the energy transition was also updated - provision was made for a reduction in demand for natural gas in Europe through faster implementation of energy efficiency measures and accelerated development of RES and clean heating. The LNG import portfolio has been diversified in the EU, but in this respect it is important to bear in mind the constant competition of the European market with other importers, especially from Asia, and the, although smaller, still significant vulnerability of the LNG trade to various risks and geopolitical factors.

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[9] Z. Nowak, *Goodbye Russia, the emancipation of European energy*, in PISM Report "Point of no return? The transformation of the global order after the Russian invasion of Ukraine', ed. M. Terlikowski, May 2023, https://www.pism.pl/publikacje/point-of-no-return-the-transformation-of-the-global-order-after-the-russian-invasion-of-ukraine.

[10] DISE Report, *Taking natural gas hostage - Geopolitics as a context for the role of natural gas in achieving energy objectives of the European Union*, December 2022, https://dise.org.pl/en/report-natural-gas-geopilitics/.

7. The role of gas storage in maintaining energy security

Piotr Dziadzio

Underground gas storage (UGS) facilities are natural reservoirs with a large storage capacity, most often using pore spaces left by depleted natural gas and oil fields (reservoir storage) and excavations made in seams or salt domes (cavern storage), less often in underground spaces of coal or salt mines or aquifers.

For reasons of both safety and development and operating costs, underground gas storage (natural gas and helium, eventually hydrogen and carbon dioxide), has developed continuously since 1915, when the first PMG in the world was commissioned in Welland County (Ontario, Canada)[11]. Since then, both the number of storage facilities and storage capacities have increased globally, with about 110 bcm in the USA and about 90 bcm[12] in Europe. The first gas storage facility in Europe was a 35.5 mcm gas storage facility in the depleted Roztoki-Sądkowa oil and gas field in Roztoki, near Jasło in the Carpathian Mountains. Its construction began in 1954 and it was in operation until 1980[13].

The UGS maintain the required levels of natural gas stocks, which are used, among other things, to meet peak demand, as well as to ensure supply during failures and interruptions in gas supply. Their operation is based on seasonality - it determines consumption. Demand rises in autumn and winter, when temperatures fall and demand in the global market is high (and the price is high), and falls in the spring and summer months, when demand falls and supply rises (and the price falls). Natural gas in warmer periods is available (in addition to long-term contracts) through short-term spot contracts or swap contracts. It may also be available from indigenous (domestic) production, which does not offer the possibility to increase it when demand increases. Domestic production can also be stored in storage facilities that have rapid withdrawal capacity (e.g. cavern storage facilities)[14].

UGSs not only fulfil the role of stabilising the gas system, but are also an important element of the commodity and energy security system. This makes both their construction and further expansion of their storage capacities necessary. In the case of Poland, it is planned to increase the capacity to the level of 4 bcm with the current, constantly increased, level of 3.33 bcm. In Poland, seven storage facilities maintain the required levels of natural gas stocks and their filling level in September is at the level of 98%[15]. In order to further increase energy security, it is also advisable to increase the current maximum gas offtake capacity from storage facilities from 53.5 mcm/day to a minimum of 60 mcm/day in the time horizon - winter season 2030/2031.

This becomes particularly important in the context of Russia's attack on Ukraine on 24 February 2022 and the complete cessation of natural gas supply from Russia to Poland from 27 April 2022 and the difficulty to predict developments in this conflict. It should be noted that Poland, understanding the imperial nature of Russia, has systematically reduced gas supplies from the East (in 2015 it imported 72%, in 2021 57% and in 2023 0%), gradually diversifying them[16]. Natural gas should be treated as a strategic raw material, both politically and economically, and thus as an important element of the country's broadly defined energy security, thus its storage is becoming an activity of high strategic importance allowing, on the one hand, further civilisational and technological development and, on the other hand, to conduct the energy transition in a sustainable manner. The situation at the turn of 2023/2024 in Europe and globally, according to IEA data, indicated weak demand and stable supply of natural gas, making it highly

[11] Polish Gas Industry, 2009. by A.Bochen, Red, Wyd. by DWE Media-QuixiMedia Sp.z.o.o.

[12] Gas Market Report, Q3-2024 (iea.blob.core.windows.net)

[13] Underground gas storage facilities - Wikipedia, the free encyclopedia

[14] Kaliski M., Janusz P., Szurlej A., 2010. Podziemne magazyny gazu jako element krajowego systemu gazowego [*Underground gas storage facilities as an element of the national gas system]* "Nafta-Gaz". 5, p. 325-332.

[15] Gas Storage Poland

[16] Dziadzio P. 2022. Strategia Rządu RP w zakresie wielosektorowej transformacji energetycznej [Government of the Republic of Poland's strategy for a multi-sectoral energy transition]. 13th Polish Oil and Gas Congress, Bóbrka, 03.06.2022.

likely that storage stocks would be rebuilt in 2024[17]. And so it happened, on 21 August natural gas stocks in European storage reached 90.02% of storage capacity (equivalent to approximately 92 bcm[3] of natural gas)[18]. The EU has reached its target of filling gas storage up to 90% of capacity, according to the Gas Storage Regulation (EU/2022/1032) well before the 1 November deadline. This is crucial for the EU's security of energy supply, as it can cover up to a third of winter gas demand. Thus, there is room for natural gas exports to, for example, Ukraine. Already today, Ukrainian gas storage facilities can offer 10 bcm[19] of storage capacity. The European Union can, therefore, play a key role in replenishing gas stocks in Ukraine and in turn supplying Moldova. Of course, this is a risky area both business-wise and politically in the context of Russia's warfare, which is destroying infrastructure, as is becoming increasingly evident in Ukraine, but one cannot do nothing and wait for the war to end, which may continue for many years to come.

8. Gas exchange and the security of gas fuel trading

Marcin Sienkiewicz

The scale of the gas market in the European Union

The gas consumption of all Member States taken together places the European Union among the world's top three consumers of gas. In 2019, the United States was in first place with a consumption of 849.2 bcm of natural gas, followed by the Russian Federation in second place with a consumption of 444.3 bcm[20] and the EU in third place with a consumption of 429.4 bcm. In 2022, this order remains unchanged as shown in the table below.

Table 1: The three largest global consumers of gas.

State	Gas consumption in 2019 in bcm	Gas consumption 2022 in bcm
United States	849.2	826.7
Russian Federation	444.3	474.6
European Union	429.4	396.6

Source: BP, *Statistical Review of World Energy 2022*.

Consumption of natural gas, as a consequence of the energy crisis, fell by around 13% year-on-year in 2022. The European Union is now seeking to reduce consumption of this fuel by promoting renewable gases such as biomethane and hydrogen. However, natural gas remains a critical raw material for many sectors of the European economy such as the chemical industry, heating and electricity.

[17] Gas Market Report, Q3-2024 (iea.blob.core.windows.net)
[18] Gas storage (europa.eu)
[19] Gas Market Report, Q3-2024 (iea.blob.core.windows.net)
[20] BP, *Statistical Review of World Energy 2021 | 70th edition*, p. 38.

Gas Target Model

Member states' gas markets operate under a single liberalised model - the Gas Target Model (GST). This structure stems from the provisions contained in the 2009 Third Energy Package. It introduced general rules for the operation of gas markets across the EU in the form of:

- separation of natural monopolies in the business of transporting gas from selling it - *unbundling*,
- third party access to transport and storage infrastructure,
- basing the activities of transmission system operators on standardised network codes,
- the right of natural gas customers to choose their supplier,
- abolishing state price regulation and introducing a market-based price-setting mechanism.

The role of gas exchanges

Gas exchanges have become an important element of the liberalised gas market, contributing to its wider infrastructure. Exchange platforms operate in almost all EU countries (except Slovakia) being also an integral part of European gas hubs such as TTF or CEGH. Gas exchanges fulfil a very important role in the proper functioning of the gas market as they:

- concentrate supply and demand for natural gas,
- provide a level playing field for market participants,
- store historical market data,
- ensure that all their participants have equal access to market information,
- enable the creation of a market price for gas,
- make a key piece of information for the national economy, gas price information, publicly available in real time.

The indices published by the stock exchanges are a statistical indicator to measure prices for a commodity such as natural gas. This allows economic operators to read prevailing market sentiment and estimate risks, which is helpful for decision-making at strategic and operational levels.

Gas exchanges make an important contribution to the safety and proper functioning of gas markets. Above all, they contribute to the certainty of trading and settlement of the transactions concluded. Transactions on exchanges are concluded anonymously on the basis of equal and identical rules for all. Close control of the exchanges by financial supervisory institutions and market regulators precludes monopolistic, corrupt or unfair competition practices. Close cooperation with the Transmission System Operators, to whom nominations are sent after concluded transactions, provides a guarantee of delivery of the purchased commodity of appropriate quality and volume. The Clearing Houses, which cooperate with the exchanges, take care of the timely flow of funds between the counterparties, which must take place as a consequence of the transaction concluded by them.

9. EU standards for identifying and monitoring threats to energy security

Jerzy Baehr

One of the objectives of the European Union's energy policy is to ensure the security of energy supply in the European Union.

There are numerous risks and hazards associated with energy security, understood as such a state of the economy that ensures that the current and future demands of fuel and energy consumers are met in a technically and economically appropriate manner, with the energy sector having a minimal negative impact on both the environment and the living conditions in a society. Achieving energy security involves, among other things, ensuring that the energy system is prepared for unusual and unpredictable events that could impede the material flow of energy or lead to a significant and economically unjustified increase in energy prices. The security of the energy supply depends on numerous factors, including technical, market, climate, or political considerations.

Energy security is facilitated by the diversification of generation capabilities, high levels of investment, a broad network of interconnected energy systems, etc.

Among the core objectives of the European Union's legislative bodies is ensuring that appropriate legislation regarding energy security is in place. Such regulations specify, *inter alia*, the authorities and organisations responsible for energy security. Issues surrounding energy security are quite dynamic in nature. The underlying economic, legal, social, or political circumstances undergo frequent and significant changes. This is why, it is so important to have a system to monitor and identify threats to energy security. Regulations provide for a complex network of interactions between various authorities and entities for reporting threats to energy security. These relate to the mutual relationships between EU authorities, regulators, as well as individual market participants and associations thereof. Of particular importance are the competences and activities of the EU Agency for the Cooperation of Energy Regulators (ACER), as well as the European Network of Transmission System Operators (ENTSO) in the areas of electricity (ENTSO-E) and gas (ENTSOG), which establish common standards and procedures regarding security and emergencies. Numerous matters regarding the identification and monitoring of threats to energy security are contained in the network codes for both electricity and gas markets.

Regulations concerning energy security are often drafted with a high degree of detail. For example, Regulation 2019/941 of 5 June 2019 on risk-preparedness in the electricity sector provides for, among others, rules on the assessment of risks to security of electricity supply, identifying regional and national electricity crisis scenarios, the establishment and contents of risk-preparedness plans, or managing electricity crises. Similarly, Regulation 2017/1938 of 25 October 2017 concerning measures to safeguard the security of gas supply governs responsibility for the security of gas supply, the establishment and contents of preventive action plans and emergency plans, the declaration of a crisis, or the application of solidarity measures.

The identification of a risk may lead to a large number of diverse consequences, such as further legislative actions, decision making processes by regulators as well as transmission or distribution system operators, or may even result in the deployment of financial support.

The energy security of EU Member States was significantly affected by Russia's aggression against Ukraine. This was particularly the case in the gas market, the availability of which was especially threatened, and resulted in a radical increase in prices. Effective monitoring and the determination to seek means of mitigating the negative impacts of these circumstances has led to the relatively rapid adoption of a range of legislative solutions. An example of such a solution is Regulation 2022/2576 of

19 December 2022 enhancing solidarity through better coordination of gas purchases, reliable price benchmarks and exchanges of gas across borders.

Although the European Union's energy policy faces controversies in many areas (regarding, e.g. the status of gas or nuclear energy or the response to climate change), it is much simpler to reach consensus regarding security, in particular on technical matters such as the identification and monitoring of threats to energy security.

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10. LNG infrastructure in Europe

Dariusz Kryczka

Introduction

Europe faces energy security challenges and the role of the liquefied natural gas (LNG) in ensuring the diversification of energy sources is crucial. In the context of geopolitical tensions and growing energy demand, LNG is becoming an indispensable element of Europe's energy strategy.

The importance of LNG for Europe's energy security

LNG offers flexibility in supply and is an alternative to traditional gas pipelines. Amid growing concerns about the reliability of natural gas supplies, LNG provides the ability to react quickly to changing market and political conditions.

Regulation shaping the LNG market

Discussion of key EU regulations affecting the LNG market, including initiatives to support the development of LNG infrastructure.

LNG imports into the EU

The EU is the world's largest importer of LNG, with annual imports of exceeding 120 billion cubic metres in 2023[21]. The largest importers in EU countries are France, Spain, the Netherlands, Belgium and Italy[22]. Germany, whose plans to first set up floating terminals and then land terminals are impressive, will also soon be joining this top group of European countries. Presentation of statistical data and analysis of import trends.

Expansion of LNG infrastructure

In response to the Ukraine crisis and the use of gas supply as a tool for policy, the EU has accelerated the expansion of LNG infrastructure. These projects are often classified as projects of common interest and benefit from simplified procedures and co-financing from the Connecting Europe Facility[23]. In 2023, the EU's import potential increased by 40 bcm, with a further increase of 30 bcm planned for 2024[24]. The EU's import potential is expected to increase by 2024.

[21] European Council, 'LNG infrastructure in the EU', available online: https://www.consilium.europa.eu/pl/infographics/lng-infrastructure-in-the-eu/ [accessed 15.04.2023].
[22] Ibid.
[23] Ibid.
[24] Ibid.

Current and emerging LNG infrastructure in Europe

A detailed discussion of existing LNG infrastructure in Europe and plans for its expansion. Particular attention will be paid to the example of Poland, with its onshore LNG terminal in Świnoujście and its planned Floating Storage Regasification Unit (FSRU) terminal in the Gulf of Gdansk.

Conclusion

LNG plays a key role in Europe's energy security strategy.

The expansion of LNG infrastructure responds to the challenges of gas supply and represents an important step towards the diversification of energy sources.

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