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Gas Supplies by Sea and Biogas as Elements of Ensuring Energy Security: The Example of Poland

Keywords: energy security, gas supply diversification, LNG, biogas

Introduction

Nowadays, almost every country is able to produce electricity and heat, but only a few of them have deposits of fossil fuels in their territories in an amount that allows them to freely meet their own needs in this area. The primary energy demand in Poland is covered in over 80% by hard coal, lignite, crude oil and natural gas.[1] Poland has resources of all the above-mentioned raw materials, but only with regard to coal they are sufficient to ensure full coverage of the demand. The domestic demand for lignite is fully satisfied by own extraction, and the exploitable lignite resources are sufficient

1 *Sprawozdania z działalności Prezesa URE za lata 2012–2020* (Warszawa: Urząd Regulacji Energetyki, 2021–20), accessed 15 June 2022, https://www.ure.gov.pl/pl/urzad/informacje-ogolne/edukacja-i-komunikacja/publikacje/sprawozdania-z-dzialaln/2916,Sprawozdania-z-dzialalnosci-Prezesa-URE.html.

for two decades.[2] With regard to hard coal, Polish mines would be able to fully meet the domestic demand for this resource for six decades.[3] In terms of natural gas, domestic extraction is able to meet no more than 20% of demand, and in the case of crude oil, less than 2%.[4]

The purpose of the considerations in this study is an attempt to identify whether the gas fuel supply by sea is capable of ensuring the security supply of this raw material to Poland. The premise for taking up this issue is the new geopolitical situation after the Russian attack on Ukraine, which radically intensified the discussion on making the European Union countries independent from the import of energy resources from Russia and other sanctioned countries. The international effects of the above-mentioned armed conflict have dramatically demonstrated the extent to which energy resources and their uninterrupted transmission constitute a key element of both national security and economic stabilisation, and are at the same time becoming the subject of international competition.[5]

The analysis of the security of gas fuel supplies to Poland in the situation of an armed conflict in the neighbouring countries having a direct impact on this supply has not been the subject of direct literature considerations so far. The literature on the subject presents only the content relating to selected aspects of the described issue. Among the items that deserve distinction, one can mention the study by Piekarski, who focuses on the military aspects of ensuring the security of raw material supplies by sea. [6] Then Donaj, Kucenko[7] and Podraza[8] describe the issues of Russia's imperial resource policy. Al-Masny analyses the political aspects of energy security from a regional and global

2 Sławomir Mazurek and Marcin Tymiński, *Węgiel brunatny*, Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy, accessed 21 June 2022, http://geoportal.pgi.gov.pl/surowce/energetyczne/wegiel_brunatny.

3 *Węgle kamienne – zasoby w Polsce we stanu na 31.12.2019*, Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy, accessed 28 June 2022, http://geoportal.pgi.gov.pl/css/surowce/images/2019/tabele/wegle_kamienne_zasoby.pdf.

4 Marcin Tymiński, *Eksport i import surowców mineralnych*, Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy, accessed 18 June 2022, http://geoportal.pgi.gov.pl/surowce/export_import.

5 Of course, it should be pointed out that not only armed conflicts, but also political decisions, terrorist activities and natural circumstances can lead to serious disruptions in the supply of energy resources.

6 Michał Piekarski, "Bezpieczeństwo dostaw surowców energetycznych do Polski drogą morską," *Wschodnioznawstwo* 14 (2020): 177–197, DOI: 10.4467/20827695WSC.20.010.13338.

7 Łukasz Donaj and Anastazja Kucenko, "Gazprom i jego wpływ na współczesne bezpieczeństwo energetyczne Unii Europejskiej. Wybrane problemy," *Przegląd Strategiczny* 2 (2011): 335–350, https://doi.org/10.14746/ps.2011.2.17.

8 Andrzej Podraza, "Bezpieczeństwo energetyczne Polski w kontekście neoimperialnej polityki Rosji oraz współpracy europejskiej i transatlantyckiej: Polska jako hub gazowy," *Sprawy Międzynarodowe* 73 (2020), 1: 135–61, https://doi.org/10.35757/SM.2020.73.1.10.

perspective.[9] Przymuszewski considers the possibilities of increasing energy security through the diversification of oil and gas supplies to Europe.[10] Ruszel[11] and Skrzyński,[12] on the other hand, evaluate the policy of the Polish authorities in the field of ensuring gas security in Poland in a several-year and long-term perspective.

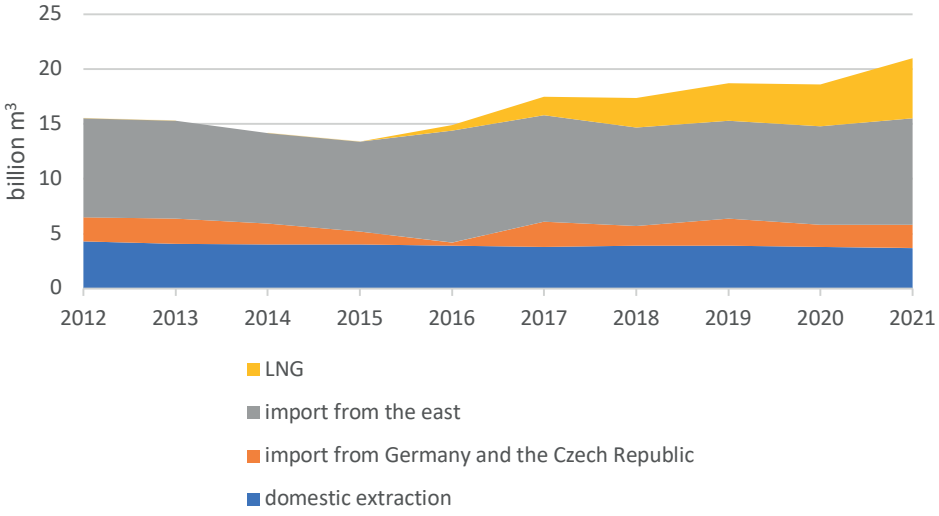

Figure 1. Sources of natural gas supply to Poland in the decade of 2012–2021

Source: own elaboration based on: *Sprawozdania z działalności Prezesa URE za lata 2012–2020* (Warszawa: Urząd Regulacji Energetyki, 2012–2020), accessed June 26, 2022, https://bip.mos.gov.pl/energetyka/sprawozdania-z-wynikow-monitorowania-bezpieczenstwa-dostaw-paliw-gazowych/.

9 Nebras Al-Masny, "Aktualne wyzwania i trendy w zapewnieniu bezpieczeństwa energetycznego w układzie globalnym i regionalnym," *Zarządzanie innowacyjne w gospodarce i biznesie* 29 (2019), 2: 13–29, https://doi.org/10.25312/2391-5129.29/2019_01nam.

10 Adam Przymuszewski, "Bezpieczeństwo energetyczne – dywersyfikacja źródeł i dróg dostaw gazu ziemnego i ropy naftowej do Europy," in: *Ochrona środowiska jako kluczowy problem Polski XXI wieku*, ed. Jacek Cheda (Warszawa: Fundacja Lus Medicina, 2012), 39–46.

11 Mariusz Ruszel, "Ocena bezpieczeństwa dostaw gazu ziemnego do Polski – stan obecny i perspektywa do 2025 r.," *Polityka Energetyczna – Energy Policy Journal* 20 (2017), 1: 5–22, https://epj.min-pan.krakow.pl/pdf-96155-28931?filename=Evaluation%20of%20the.pdf.

12 Tomasz Skrzyński, "Zapewnienie bezpieczeństwa energetycznego Polski odnośnie gazu ziemnego według projektu Polityki energetycznej Polski do 2040 Roku," *Annales Universitatis Paedagogicae Cracoviensis, Studia de Securitate* 9 (2019), 3: 31–36, DOI 10.24917/26578549.9.3.3.

According to the Energy Outlook 2019 report published by the BP concern[13] and the assumptions of Poland's Energy Policy until 2040 (PEP2040),[14] Poland will belong to the oil and gas importing countries for at least the next 20 years. It will not be changed significantly by the increase in the share of renewable energy sources, as they will, in principle, replace coal in the first place. It is important because the exploitation of hard coal and lignite deposits owned by Poland may turn out to be pointless in the future, especially for ecological and economic reasons. Despite the efforts declared by the Polish government to further exploit these deposits, contrary to the firm expectations of the European Union, it should be considered a probable scenario in which the use of coal for energy production will gradually decrease.

The current dominant share of coal in domestic energy production is a consequence of the historical conditions in which the Polish economy developed and the Polish state functioned in the 20th century. Starting the transformation of its economy towards a free market model, in the face of mounting structural, financial, and social problems, Poland could not consider a radical change in the structure of energy generation sources as a priority objective. Despite this, over the last 30 years it has been possible to significantly reduce the dominance of coal in the energy sector, improve the energy efficiency of the entire economy and, above all, significantly reduce its emission intensity. The deep transformation of the Polish energy sector, initiated in recent years, is assumed to assign a significant role to fuel gas. The nationwide consumption of natural gas in Poland is systematically increasing, which in relation to the past decade, broken down into groups of significant gas sources, is shown in Figure 1.

The increased demand for natural gas in Poland is related to the increasing use of it in cogeneration (simultaneous production of heat and electricity) and gas and steam power plants, primarily as back-up, regulatory and peak powers.[15] Therefore, apart from investments in gas production infrastructure, investments in transmission infrastructure[16] will be of significant importance for balancing the power system. According to the estimates presented by the Gas Transmission Operator Gaz-System S.A.,

13 *BP Energy Outlook 2019 edition*, BP, accessed 25 June 2022, https://www.bp.com/content/dam/bp/business-sites en/global/corporate/pdfs/energy-economics/energy-outlook/bp-energy-outlook-2019.pdf, 12–19.

14 *Założenia do aktualizacji PEP2040-wzmocnienie bezpieczeństwa i niezależności energetycznej* (Warszawa: Ministerstwo Klimatu i Środowiska, marzec 2022), Portal Gov.pl, accessed 11 June 2022, https://www.gov.pl/web/premier/zalozenia-do-aktualizacji-polityki-energetycznej-polski-do-2040-r-pep2040--wzmocnienie-bezpieczenstwa-i-niezaleznosci-energetycznej.

15 The current energy system in Poland, based mainly on coal power plants, is inflexible, which results from the lack of technical adaptation of coal-fired units to sudden changes in the loads in their operation.

16 *Krajowy plan na rzecz energii i klimatu na lata 2021–2030* (Warszawa: Ministerstwo Klimatu i Środowiska, 2019), Załącznik 2, accessed 24 June 2022, https://www.gov.pl/web/klimat/krajowy-plan-na-rzecz-energii-i-klimatu.

which dominates the Polish market, the demand for natural gas in the energy sector is to increase from the level of 4.2 billion cubic metres in 2020 to the maximum level of 13.4 billion cubic metres in 2036, and then slightly decrease.[17] In the light of the presented assumptions, the strategic importance of gas for the creation of economic development and the functioning of Poland cannot be questioned.

In 2021, natural gas consumption in Poland reached the historic maximum of approximately 21.1 billion cubic metres, of which 9.7 billion cubic metres was imported via pipelines from Russia and 2.3 billion cubic metres from the west and south (including 1.42 billion cubic metres from PGNiG's own deposits[18] in Norway), 5.5 billion cubic metres was obtained in the form of liquefied gas delivered by sea, and 3.7 billion cubic metres constituted the domestic production of natural gas.[19] The geographical distribution and technical transmission capacity of all cross-border entry points to the Polish gas system are presented in Table 1.

Table 1. Cross-border entry points to the Polish gas transmission system, as of 1 August 2022

Entry point	Direction	Technical capacity in billion cubic metres/year
Mallnow	West/Germany	5.4
GCP GAZ System Ontras	West/Germany	1.5
Cieszyn	South/ the Czech Republic	0.5
LNG Terminal/Świnoujście	Northwest/LNG worldwide market	6.2
GIPL/ Poland-Lithuania	Northeast/ Lithuania	1.9
Poland-Slovakia Interconnector	South/ the Czech Republic	5.7
Kondratki (Yamal)	East/ Belarus	30.7
Teterovka	East/ Belarus	0.2
Vysokoye	East/ Belarus	5.5
Drozdovici	East/ Ukraine	4.4

Source: *Połączenia międzysystemowe*, Gaz-System S.A., accessed 27 June 2022, https://www.gaz-system.pl/ea/rr2015/polaczenia-miedzysystemowe.html.

17 *Krajowy dziesięcioletni plan rozwoju systemu przesyłowego. Plan rozwoju w zakresie zaspokojenia obecnego i przyszłego zapotrzebowania na paliwa gazowe na lata 2022–2031* (Warszawa: Gaz-System S.A., kwiecień 2021), accessed 5 June 2022, https://www.gaz-system.pl/fileadmin/centrum_prasowe/Aktualnosci/20210413_KDPR_2022_2031_wyciag_do_kosultacji.pdf, 12–16; *Wnioski z analiz prognostycznych dla sektora energetycznego Polityka energetyczna Polski do 2040 r.* (Warszawa: Ministerstwo Klimatu i Środowiska, 2020), Portal Gov.pl, accessed 3 June 2022, https://bip.mos.gov.pl/fileadmin/user_upload/bip/strategie_plany_programy/Polityka_energetyczna_Polski/zal._2_do_PEP2040_-_Wnioski_z_analiz_prognostycznych_2021-02-02.pdf, 36–47.

18 The share of Polskie Górnictwo Naftowe i Gazownictwo (PGNiG) in the exploitation of domestic and foreign gas fields by Polish economic entities is 98.8%. The long-range forecast of PGNiG concerns the year 2024 and assumes obtaining 3.9 billion m³ from Polish deposits and 2.9 billion m³ from Norwegian deposits.

19 *Sprawozdania z działalności Prezesa URE za lata 2012–2020.*

After Russia unilaterally halted the supply of natural gas to Poland in April 2022, the total domestic supply gap for the annual demand, at the level of 2021, could reach nearly 5 billion cubic metres throughout 2022 (assuming that the already satisfied demand for gas from the east was proportionately higher in the first, winter quarter of 2022). The coverage of this shortage may be partially from domestic natural gas reserves, the amount of which amounts to 3.2 billion cubic metres.[20] Supplementing the rest may be problematic, because a large part of Europe is struggling with limited access to natural gas. With a high probability, however, it can be assumed[21] that the demand for natural gas in 2022 in Poland will not reach the level of 2021 due to a drastic increase in the price of this fuel, resulting in a decrease in demand. In the long-term perspective, the problem of access to a significantly larger amount of gas than today, mainly due to the needs of the previously mentioned modernisation investments in the energy sector, becomes critically important for Poland's energy security.

The concept of energy security of Poland in relation to fuel gas

Ensuring energy security is a complex process influenced by many factors. Decisions taken in this area are mostly both strategic and political in nature, and obviously generate serious consequences for the entire economy and society. In scientific terms, energy security is one of the interdisciplinary theoretical concepts. Due to its specificity, it is located between political science, economics and technical sciences.[22] In the political science sense, energy security is related to ensuring the continuity of energy supplies in an economically- and technically-justified manner, while respecting the environment. In economic terms, energy security refers to the energy market, its structure and connections that enable effective counteracting of the impact of external factors that may weaken the development of this market.[23] Security of supply can therefore be considered in two dimensions: internal, which aims to balance energy demand and supply – while maintaining environmental standards, and external, which is related to filling the gap between domestic energy production and domestic demand for energy. Thus, the internal dimension includes the management of energy available

20 *Sprawozdania z działalności Prezesa URE za lata 2012–2020.*

21 The state-owned company Gaz-System S.A., which is responsible for the transmission of natural gas in Poland, estimates this year's Polish gas consumption at 18 billion cubic metres.

22 Krzysztof Tomaszewski, "Wpływ inwestycji infrastrukturalnych w sektorze gazowym na bezpieczeństwo energetyczne Europy Środkowo-Wschodniej," Środkowoeuropejskie Studia Polityczne, 3 (2017): 73–96, accessed 26 May 2022, DOI 10.14746/ssp.2017.3.4.

23 Tomasz Kaźmierczak, *Bezpieczeństwo energetyczne – uzależnienie Polski od importu gazu ziemnego* (Warszawa: Promotor, 2008), 23–41; Krzysztof. M. Księżopolski, *Ekonomiczne zagrożenia bezpieczeństwa państw. Metody i środki przeciwdziałania* (Warszawa: Elipsa, Warszawa 2007), 33–39.

in the country, coming both from domestic production and imports, and the external dimension – supplementing domestic energy needs with imports.[24] The purpose of energy security understood in this way is to ensure an adequate and reliable level of supply of affordable energy carriers in a way that does not threaten the fundamental values and goals of the state.[25]

Based on the so-called negative formulation of the issue of energy security, it can be assumed that a breach of energy security occurs when, as a result of a change in the continuity of energy supplies and its carriers, there is a loss of prosperity, understood as a slowdown in the growth rate, or even a decrease in Gross Domestic Product (GDP).[26] Measures of security of supply are based on concentration or dispersion indicators, which can be supplemented with elements related to the geopolitical stability of the supplier and its raw material base.[27]

The Polish Act on Energy Law[28] defines energy security as the state of the economy in which it is possible to cover the current and future customer demand for fuels and energy in a technically- and economically-justified manner, while maintaining environmental protection requirements. Undisturbed access to carriers is considered to be of decisive importance for the material standard and quality of life of the population as well as for the functioning and development of enterprises. Therefore, energy security also has a significant impact on maintaining the socio-political stability of the state. The methods of ensuring energy security include: energy self-sufficiency, diversification of energy supplies, rationalisation of energy consumption, expansion of storage space and introduction of new energy sources to the energy balance sheet.[29]

Increasing the share of natural gas in energy production must go hand in hand with the guarantees of gaseous fuel availability on the market. These guarantees should result from solutions of a systemic nature, neutralising internal and external threats to the continuity of gaseous fuel supplies. The official list of possible causes of

24 Paweł Czerpak, "Bezpieczeństwo energetyczne," in: *Bezpieczeństwo międzynarodowe. Teoria i praktyka*, eds. Katarzyna Żukrowska et.al., 121–136 (Warszawa: Szkoła Główna Handlowa, 2006).

25 Daniel Yergin, "Energy Security in the 1990s," *Foreign Affairs*, 67 (1988), 1: 6–9. accessed 30 June 2022, https://www.foreignaffairs.com/articles/united-states/1988-09-01/energy-security-1990s, https://doi.org/10.2307/20043677.

26 Douglas R. Bohi and Michael A. Toman, *The Economics of Energy Security* (Massachusetts: Kluwer Academic Publishers,1996), accessed 25 May 2022, https://link.springer.com/content/pdf/10.1007/978-94-009-1808-5.pdf, 12–16.

27 Andreas Lóschel, et.al., "Indicators of energy security in industrialised countries," *Energy Policy* 38 (2010), 4: 1665–69, accessed 27 May 2022, https://doi.org/10.1016/j.enpol.2009.03.061; Bert Kruyt, et.al., "Indicators for energy security," *Energy Policy* 37 (2009), 6: 2166–72, accessed May 26, 2022, https://doi.org/10.1016/j.enpol.2009.02.006.

28 Ustawa z dnia 10 kwietnia 1997 r., Prawo energetyczne, Dz. U. Nr 54 z 2019 r. poz. 348 z późn. zm.

29 Honorata Nyga-Łukaszewska, "Czy bezpieczeństwo energetyczne oznacza konkurencyjność w skali międzynarodowej?", *International Business and Global Economy* 35 (2016), 1: 390–401, https://doi.org/10.4467/23539496IB.16.028.5609.

disturbances in the proper functioning of the gas system in Poland is included in the National Crisis Management Plan, prepared by the Government Centre for Security.[30] One of the 10 discussed reasons indicated in the above-mentioned document is the possibility of unfavourable events in the international environment, i.e. political and economic conflicts in the countries supplying natural gas or transit countries, resulting in restrictions or interruptions in natural gas supplies.

Measures to remove or mitigate risks and hazards in natural gas supplies are included in the Preventive Action Plan[31]. As included in this document, in the event of risk materialisation in the form of disruptions in the supply of imported gas (reduction or cessation of supplies), the state has two categories of remedial measures, i.e. market and non-market measures. Market measures include launching additional natural gas supplies from other sources or directions and reducing the consumption of natural gas by consumers, in accordance with the contracts concluded with them. The use of non-market measures covers the administrative possibilities of limiting the consumption of natural gas and activating the obligatory reserves of natural gas, which are required to be maintained by energy companies conducting economic activity in the field of foreign trade in natural gas and entities importing natural gas.

With regard to the supply of natural gas to Poland, starting from the 1990s, the risk of interruptions in supplies from the East was identified as the greatest risk. Events of this type occurred several times after 1990, but never on a scale that would pose a real threat to the energy security of the country. The shortages were each time fully compensated by the natural gas reserves maintained by Poland.[32] As a result of the current intensification of the conflict between Russia and Ukraine, initiated in 2014, to a full-scale war, the resignation from gas supplies (and other energy resources) from the east has become a priority for Poland, as for most EU countries. The previously indicated anticipation by Poland of the threat of cessation of supplies of strategic raw materials from Russia has for many years resulted in taking actions aimed at radically increasing Polish capacity to diversify natural gas supply sources. The domestic production of natural gas has limited capacity in this respect, which has been gradually declining for many years due to objective technical and geological reasons, despite the fact that the

30 *Krajowy Plan Zarządzania Kryzysowego, Rządowe Centrum Bezpieczeństwa* (Warszawa: Rządowe Centrum Bezpieczeństwa, n.d.), accessed 3 June 2022, https://www.gov.pl/web/rcb/krajowy-plan-zarzadzania-kryzysowego.

31 Plan na wypadek sytuacji nadzwyczajnej opracowany na podstawie art. 8 ust 2 lit. B, Rozporządzenia Parlamentu Europejskiego i Rady (UE) Nr 2017/1938 z 25 października 2017 r., dot. środków zapewniających bezpieczeństwo dostaw gazu ziemnego i uchylające rozporządzenie (UE) Nr 994/2010, Dz.U.UE.L.2017.280.1 (Warszawa: Minister Energii, 2019), 15–17.

32 Ustawa z Dnia 16 Lutego 2007 r. o zapasach ropy naftowej, produktów naftowych i gazu ziemnego oraz zasadach postępowania w sytuacjach zagrożenia bezpieczeństwa paliwowego państwa i zakłóceniach na rynku naftowym, Dz.U. 2007, nr 52, poz. 343 z późn. zm., 3198–3200.

state of recoverable natural gas resources in Poland is close to 140 billion cubic metres.[33] It should be added that PGNiG holds interests in 59 licences on the Norwegian Continental Shelf and produces from fourteen fields, from which approximately 40 billion cubic metres of natural gas can be exploited.[34]

Efforts made by Poland so far to diversify natural gas supplies include five strategic projects: new interconnections with Slovakia, LNG (*liquefied natural gas*) terminals in Świnoujście and Gdańsk, and the Baltic Pipe gas pipeline. The construction and commissioning of interconnectors as part of the first two projects were completed in May and July 2022, respectively. Gas Interconnection Poland-Lithuania (GIPL) allows Poland access to the LNG terminal, which is located in Lithuania in Klaipeda, which is very important in the context of gasification of the north-eastern regions of Poland. Thanks to this connection, Poland gains access to the Floating Storage Regasification Unit (FSRU), which is located in Klaipeda, Lithuania. The Klaipėdos Nafta operating FSRU is considering the possibility of expanding the terminal's regasification capacity from the current 3.75 billion cubic metres to 5 billion cubic metres in the long term.[35]

As regards the implementation of the interconnection with Slovakia, it should be noted that this connection, on the one hand, provides Slovakia and the countries of the region with direct access to new sources of gas supplies from the north, and on the other hand, it enables the Polish market to access gas from the so-called Southern Gas Corridor (the Trans-Adriatic Gas Pipeline), which transports the raw material extracted in the Caspian Sea region and in the eastern part of the Mediterranean basin (Cyprus gas fields).[36]

The third of the indicated strategic projects to diversify gas supplies to Poland is the LNG terminal in Świnoujście, which started operating in 2016. The construction of the LNG terminal made it possible to receive liquefied natural gas by sea from anywhere in the world. The initial regasification capacity of the terminal was 5 billion cubic metres per year. Starting from 2022, the terminal in Świnoujście can already provide up to 6.2 billion cubic metres of natural gas, and in the years 2024–2038, as a result of the planned expansion, this value is to reach 8.3 billion cubic metres.[37] It should be indicat-

33 *Gaz ziemny, zasoby i wydobycie*, Państwowy Instytut Geologiczny – Państwowy Instytut Badawczy, accessed 25 June 2022, http://geoportal.pgi.gov.pl/surowce/energetyczne/gaz_ziemny/2020.

34 *Prognozy operacyjne i finansowe,* PGNiG, accessed 24 June 2022, https://pgnig.pl/relacje-inwestorskie/informacje-gieldowe/prognozy-finansowe.

35 *Gaz z Litwy płynie do Polski*, Parkiet.com, accessed 2 July 2022, https://www.parkiet.com/surowce-i-paliwa/art36218571-gaz-z-litwy-plynie-do-polski.

36 *Gazowe Połączenia Międzysystemowe Polska-Słowacja*, Gaz-System S.A., accessed 2 July 2022, https://www.gaz-system.pl/dam/jcr:f8f093d0-6a46-4465-b40f-0322738f9e68/160808-os-pl-sk-project-description.pdf.

37 *Sprawozdanie MKIŚ z wyników monitorowania bezpieczeństwa dostaw paliw gazowych za okres od dnia 1 stycznia 2020 r. do dnia 31 grudnia 2020 r.* (Warszawa: Ministerstwo Klimatu i Środowiska, czerwiec

ed that liquefied gas, due to its characteristics,[38] is one of the most promising methods of ensuring security of supply through the diversification of raw material sources, because it enables the use of large reserves of this fuel that are available in distant parts of the world. The development of this project is also stimulated by the depletion of the capacity of the existing transmission gas pipelines. LNG can be delivered in tanks to places where there is no pipeline infrastructure; it is also used as a quick replenishment in the event of a local pressure drop in gas pipelines, or as an alternative source in the event of renovation or reconstruction of the gas network.

In principle, LNG is to play a key role in the process of diversifying supplies to the EU. There are 28 LNG terminals in Europe, 24 of which are located within the countries belonging to the European Union. The current LNG import capacity in the EU is over 200 billion cubic metres, of which more than half has been used in the last three years. The most developed LNG infrastructure is on the Iberian Peninsula. Spain has the possibility of receiving 60 billion cubic metres in its terminals, France over 30 billion cubic metres, and Italy about 15 billion cubic metres. However, the existing gas pipeline connection of the countries of southern Europe with the rest of the continent is limited, for example Spain has only less than 7 billion cubic meters of land cross-border transmission capacity.[39]

The fourth of the listed strategic projects to diversify gas supplies to Poland is the construction of the Floating Storage Regasification Unit (FSRU) in the Bay of Gdańsk. The choice of location results from the forecasted increase in gas demand in the Gdańsk agglomeration and its vicinity and the need to properly shape gas flows in the transmission system, taking into account large volumes of gas that will be injected into the gas system in the western part of the country, through the LNG terminal in Świnoujście and the Baltic Pipe. The first stage, ensuring a capacity of at least 4.5 billion cubic metres, is planned for commissioning after 2025. The expansion of the FSRU will depend on the development of the market in the region and the increase in demand for natural gas in the country.[40]

The last discussed project in the field of diversification of natural gas supplies is the partly offshore Baltic Pipe gas pipeline, which is to connect the Polish transmission

2021), accessed 4 June 2022, https://bip.mos.gov.pl/energetyka/sprawozdania-z-wynikow-monitorowania-bezpieczenstwa-dostaw-paliw-gazowych/.

38 LNG is a liquid obtained in the cooling process at a temperature of about – 162 degrees Celsius. Liquefied natural gas has a volume 600 times smaller than the raw material in its natural state. A conventional gas carrier transports approx. 70 thousand tonnes of LNG, which after regasification gives approximately 95 million cubic metres of natural gas.

39 Kamil Lipiński, Magdalena Maj and Maciej Miniszewski, *Unia Europejska niezależna od Rosji? Alternatywne źródła dostaw surowców energetycznych* (Warszawa: Polski Instytut Ekonomiczny, 2022), 25–26.

40 See: *Krajowy dziesięcioletni plan*.

system with the Europipe II pipeline, allowing access to gas from Norwegian fields through the North Sea, Denmark and the Baltic Sea. The construction of the Polish-Norwegian gas pipeline in Poland was an important element of the political debate related to the issue of energy security. One of the key aspects raised by the supporters of the project was the assessment that the investment would lead to a real diversification of the sources and directions of natural gas supplies. The opponents of this concept pointed to the high price of Norwegian gas, which in the future may have an impact on the pace of economic growth and the competitiveness of Polish enterprises.[41]

In September 2001, PGNiG SA and Statoil signed a contract called the Norwegian trade contract for gas supplies to Poland for the amount of 5 billion cubic metres annually through a direct connection with the supplier's deposits.[42] The first gas supplies (mostly using a 1,400-kilometre-long offshore gas pipeline) were to reach Poland in 2008.[43] This project was rejected due to the higher prices of Norwegian gas in relation to the Russian gas contracted at that time.

In 2015, the Baltic Pipe gas pipeline was considered a project of strategic importance for Poland's energy security. Its implementation is planned as part of the investment program for the years 2015–2025. The aim of the project was to build a new gas supply corridor from Norway to the Danish and Polish markets. In 2017, a memorandum on cooperation between Poland and Denmark was signed, and the Baltic Pipe gas pipeline was granted the status of *Project of Common Interest* granted by the European Commission to infrastructure projects aimed at strengthening the European internal energy market, as part of the implementation of the EU energy policy objectives as part of the North-South Gas Corridor. In a strategic assumption, the Baltic Pipe is part of a wider Three Seas Initiative – a strategy for integrating the energy systems of Central and Eastern European countries.

The actual implementation of the project began in the spring of 2021, when the Polish operator of the gas transmission system Gaz-System S.A., in cooperation with the Danish operator Energinet, started the construction of a new gas pipeline from Norway to Poland via Denmark. On the basis of strategic assumptions, Poland has started construction of over 2,000 km of gas pipelines in the west, east and south of the country, and the Baltic Pipe gas pipeline is to fill the gaps in the transport of natural

41 Michał Paszkowski, "Gazociąg Baltic Pipe w koncepcjach zapewnienia bezpieczeństwa energetycznego Polski w myśli politycznej Sojuszu Lewicy Demokratycznej oraz Polskiego Stronnictwa Ludowego," *Studia i analizy nauk o polityce* 1(2022): 49–61, https://doi.org/10.31743/sanp.13556.

42 *Spotkanie w sprawie dostaw norweskiego gazu do Polski*, PGNIG S.A., accessed 5 June 2022 https://pgnig.pl/aktualnosci/-/news-list/id/spotkanie-w-sprawie-dostaw-norweskiego-gazu-do-polski/newsGroupId/10184.

43 Dariusz Malinowski, *Wraca idea gazowego łącznika ze Skandynawią*, WNP. PL, Portal Gospodarczy, accessed 4 June 2022, https://www.wnp.pl/artykuly/wraca-idea-gazowego-lacznika-ze-skandynawia,270204.html.

gas in the north of the country. The expansion of the Polish transmission network related to the implementation of the Baltic Pipe project, covering 2,000 km of gas pipelines, will strengthen the country's energy security and will allow the diversification of gas supplies to neighbouring countries of Lithuania, Slovakia, the Czech Republic and Ukraine, which are still heavily dependent on gas supplies from Russia.

The Baltic Pipe gas pipeline will consist of five key elements, two of which are offshore: a gas pipeline connecting the Norwegian and Danish gas transmission systems, and a gas pipeline connecting the Danish and Polish transmission systems. The aboveground part will consist of three parts – the expansion of the Danish and Polish transmission systems and the construction of a gas compressor station in Denmark. Like the Nord Stream gas pipeline system, part of the Baltic Pipe route will run along the seabed of the Baltic Sea.[44]

The pipeline with a planned capacity of 10 billion cubic metres is expected to be put into operation by the end of 2022.[45] In the fourth quarter of 2022, the capacity of 0.7 billion cubic metres will be available in the Baltic Pipe gas pipeline, which will increase to 2.5 billion cubic metres per quarter in 2023.[46]

The assumption is that the Baltic Pipe gas pipeline is primarily intended to eliminate Poland's dependence on short-term gas supplies from Russia, accelerate energy integration in the region of Central and Eastern Europe, and give Poland a chance to become a gas hub for Eastern Europe.[47] The weaknesses and threats to the Baltic Pipe gas pipeline include its low capacity, the actual lack of an extensive transmission infrastructure in the region and the depletion of Norwegian gas resources in the North Sea (probable lack of necessary gas volumes in the medium-term).[48]

The last three of the described projects should be considered essential for ensuring the security of gas supplies to Poland. Without diminishing the importance of the first two investments, it should be noted that the interconnector capacity with Lithuania is currently relatively low, which may cover less than 10% of the current domestic gas fuel demand. In turn, the connection with Slovakia, according to the statement of the Polish government,[49] is dedicated primarily to the transmission of gas to Slovakia;

44 Oksana Voytyuk, "The Baltic Pipe and its impact on energy security in Central and Eastern Europe," *Polityka Energetyczna – Energy Policy Journal* 25 (2022), 1: 89–108, DOI: 10.33223/epj/145554.

45 Umowa między Rzecząpospolitą Polską a Królestwem Danii w sprawie projektu Baltic Pipe, podpisana w Katowicach dnia 11 grudnia 2018 r., Dz.U.2019.1263, accessed 5 June 2022, https://sip.lex.pl/akty-prawne/dzu-dziennik-ustaw/dania-polska-umowa-w-sprawie-projektu-baltic-pipe-katowice-2018-12-11-18872716.

46 Piekarski, "Bezpieczeństwo dostaw."

47 Voytyuk, "The Baltic Pipe."

48 *Export of Norwegian gas and oil 2021*, Norwegian Petroleum, accessed 10 June 2022, https://www.norskpetroleum.no/en/production-and-exports/exports-of-oil-and-gas/.

49 Wojciech Jakóbik, *Gaz z Południa dla Polski*, Biznes Alert, accessed 30 May 2022, https://biznesalert.pl/jakobik-gaz-z-poludnia-dla-polski-analiza/.

moreover, the raw material from the Trans-Adriatic Gas Pipeline, with a capacity of 10 billion cubic metres per year, goes to recipients from Southern Europe, mainly to Italy, Greece and Bulgaria.[50]

Policy of the EU and Poland with regard to the use of gas in the energy sector

A long-term vision of the EU is to achieve climate neutrality by 2050. In line with the EU's ambition to decarbonise the EU, in December 2020 the European Council endorsed a binding EU target to reduce net greenhouse gas emissions by 2030 by at least 55%, compared to the 1990 level. Thus, the current 40% reduction target was increased.[51] The new EU ambition has been defined as a collective goal for the entire Union, i.e. implemented on the basis of contributions from member states, taking into account national conditions, specific starting points, reduction potential, the principle of sovereignty in shaping the national energy mix, the need to guarantee energy security; in the most cost-effective manner possible in order to maintain affordable energy prices for households and the competitiveness of the EU, as well as taking into account the principle of fairness and solidarity. The Strategy for the Integration of the European Union's Energy System,[52] published in July 2020, set out that for two decades gas was to be an intermediate fuel on the way to decarbonise the European Union. By 2050, its share in energy production is to be gradually reduced to the level of 20%, the remaining 80% are to be renewable energy sources. The European Commission treats natural gas as a fossil fuel, contributing to the emission of greenhouse gases.

Russia's military aggression against Ukraine in 2022 resulted in the EU adopting the REPowerEU plan[53] aimed at accelerating the reduction of dependence on Russian fossil fuels. This plan sets out to achieve a reduction of at least 55% net greenhouse gas emissions by 2030 and the EU to be climate neutral by 2050. The accelerated pathway

50 *Południowy korytarz osiągnie przepustowość w przyszłym oku*, Energetyka24, accessed 23 May 2022, https://energetyka24.com/gaz/poludniowy-korytarz-gazowy-osiagnie-pelna-przepustowosc-w-przyszlym-r.

51 *Fit for 55*, Rada Unii Europejskiej, accessed 17 June 2022, https://www.consilium.europa.eu/pl/policies/green-deal/fit-for-55-the-eu-plan-for-a-green-transition/.

52 *Komunikat Komisji do Parlamentu Europejskiego, Rady Europejskiej, Rady, Komitetu Ekonomiczno-Społecznego i Komitetu Regionów, Europejski Zielony Ład*, EUR-Lex (Bruksela: Komisja Europejska, 11.12.2019), accessed 4 June 2022, https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=COM%3A2019%3A640%3AFIN.

53 *Komunikat Komisji do Parlamentu Europejskiego, Rady Europejskiej, Rady, Europejskiego Komitetu Ekonomiczno-Społecznego i Komitetu Regionów. REPowerEU: Wspólne europejskie działania w kierunku bezpiecznej i zrównoważonej energii po przystępnej cenie*, EUR-Lex (Strasburg: Komisja Europejska, 8.03.2022), accessed 7 June 2022, https://eur-lex.europa.eu/legal-content/PL/TXT/?uri=CELEX:52022DC0108.

of decarbonisation is therefore based on the goal of completely eliminating natural gas by 2050.

As of the end of 2020, the EU countries with the highest share of renewable energy in the energy mix are: Sweden (60%), Finland (44%) and Latvia (42%), Poland ranks twenty-second (16%) and Malta (11%) is the last.[54] These results show how challenging the assumptions of the EU's energy policy are for us and how distant the goal is to achieve climate and energy neutrality by 2050.

Natural gas availability on the global market

In recent years, an average of 150 billion cubic metres of Russian gas has been imported to EU countries, and the EU intends to reduce this volume by two-thirds by the end of 2022. The average annual own production of the European Union countries, accounting for 1/9 of the total demand, amounted to approximately 50 billion cubic metres. The possibilities of increasing this extraction are problematic for technological, geological and social reasons.[55] In 2021, 25% of natural gas imported by the EU was obtained from Norway.[56] In 2022, sales of Norwegian gas to the EU may increase by no more than 8%, to 122 billion cubic metres.[57]

To replace Russian gas, the EU plans to import most of the natural gas it needs in the form of LNG. This may be problematic, as the global demand for LNG in 2022 is estimated at approximately 436 million tonnes, and the supply is 410 million tonnes.[58] It is impossible to compensate for this disproportion in the short term. The implementation of new export terminals and transport infrastructure requires several years to balance supply and demand in the global LNG market.

54 *Renewable energy statistics*, Eurostat Statistics Explained, accessed 28 June 2022, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics.

55 Half of the EU's gas production is in the Netherlands, but this production is causing regular earthquakes in the region. Their frequency increases with depletion of the deposit. The initiatives taken by the Dutch government to increase production are strongly opposed by the local community. Barbara Rogala, *Nie tylko Rosja – gdzie w Europie są złoża gazu ziemnego*, 300Gospodarka, accessed 31 June 2022, https://300gospodarka.pl/analizy/nie-tylko-rosja-gdzie-w-europie-sa-zloza-gazu-ziemnego.

56 *EU imports of energy products – recent developments*, Eurostat Statistics Explained, accessed 17 June 2022, https://ec.europa.eu/eurostat/statistics-explained/index.php?title=EU_imports_of_energy_products_-_recent_developments#Member_States.27_trade_in_petroleum_oils_and_natural_gas.

57 Kate Abnett and Nora Buli, *EU, Norway agree to increase gas deliveries as Russian cut deepen*, Reuters, accessed 17 June 2022, https://www.reuters.com/business/energy/eu-norway-agree-increase-gas-deliveries-russian-cuts-deepen-2022-06-23/.

58 Sanja Pekic, *Rystad: European LNG supply crisis expected in winter 2022*, Offshore Energy, accessed 27 June 2022, https://www.offshore-energy.biz/rystad-european-lng-supply-crisis-expected-in-winter-2022/.

Europe and Asia are primarily competing for LNG, as Japan, China and South Korea are among the largest LNG importers. The recovery of Asian economies after pandemic restrictions caused Asian countries to increase their demand for LNG in 2022, and they are ready to pay more for this gas than consumers in Europe. Power plants in South Korea and Japan, anticipating that Europe, which would abandon Russian gas, would accumulate more gas than in previous years, made an attempt to secure their own needs by contracting the maximum possible number of LNG loads. In 2022, mainly supplies ordered under long-term contracts flow to Europe. An additional problem is that there is no spare shipping capacity in the global gas industry. Although nearly 500 LNG tankers are available worldwide, demand exceeds supply.

There are no cryogenic gas tankers in the Polish merchant fleet that would allow the transport of LNG. In the first half of 2022, PGNiG used short-term charter agreements for three vessels, two of which had previously delivered LNG loads to the terminal in Świnoujście. PGNiG has also signed long-term charter contracts (10-year period) for eight newly-built units, the first two of which will come into use in 2023, another two in 2024, and the remaining four in 2025. According to the target-unloading needs, Poland needs a fleet of 20 gas tankers in the following years.[59]

The Polish gas market is part of the European common market, which, in addition to numerous benefits in terms of fuel trading, also means that supply crises (and related price shocks) in Europe affect the Polish market. PGNiG is not able to completely fill the new pipeline with gas, i.e. contract a sufficient amount of gas from Norwegian or Danish partners. The Polish company reserved the vast majority of the Baltic Pipe capacity. Based on the contracts signed, as at the end of the second quarter of 2022, PGNiG has 4.5 billion cubic metres of gas at its disposal in 2023 for transmission by Baltic Pipe, which is less than half of the transmission capacity. The Baltic Pipe gas pipeline draws gas from the Europipe II pipeline connecting Norway with Germany and in the current crisis situation in Western Europe there are so many people willing to buy Norwegian gas that in practice it may make it impossible to fully use the Baltic Pipe capacity.

It should be added that while the ongoing energy transformation essentially obstructs the EU countries from reducing gas demand by returning to coal-based energy, it is different in most Asian countries, where the rigours of decarbonisation do not apply. Problems with access to LNG may slow down the growth of demand in Asia, where it is likely to partially restore the energy based on coal and fuel oil. There are signs of such a return to coal on a large scale in China and India. This, in turn, is likely to reduce the demand pressure, which will lead to a decline in LNG prices. Current

59 Przemysław Ciszak, Polsce potrzebna jest własna flota gazowców. Na razie nie mamy żadnego, Money.pl, accessed 31 June 2022, https://www.money.pl/gielda/polsce-potrzebna-jest-wlasna-flota-gazowcow-na-razie-nie-mamy-zadnego-6789643539901056a.html.

estimates for 2023, however, predict an increase in demand for LNG by around 5%. The global gas crisis strengthens the position of LNG in the global gas market, and perhaps also its importance in the energy transformation.[60]

Biogas as an alternative to natural gas

The EU's planned reduction of the share of gas in energy production to 20% in 2050 requires reflection: what will happen with the existing gas infrastructure and power plants, which currently require natural gas? Hydrogen is the favoured alternative to gas in the EU, but the technologies associated with its wide use are still being developed and, in practice, there is currently no possibility of transporting and burning hydrogen using the classic gas infrastructure. The concept of replacing part of the natural gas in gas networks with purified biogas, i.e. biomethane, seems to be much more realistic.[61] From the point of view of chemical composition, biomethane does not differ much from methane-rich natural gas,[62] therefore, from the technological point of view, it can be mixed in any proportions with natural gas and sent through distribution networks to consumers.[63] According to researchers from the University of Life Sciences in Poznań, the annual potential of biomethane production in Poland ranges from 7 to 8 billion cubic metres.[64]

It should be pointed out that biogas plants are the most stable source of renewable energy – even more than hydroelectric power plants, for the operation of which the decrease in river levels as a result of insufficient rainfall is a serious threat. Regardless of the production of electricity and heat, biogas plants can also operate as biomethane plants that produce methane pumped into the gas network with parameters better than natural gas. According to the report of the European Biogas Association, the development of this sector has the potential to bring biomethane production to 22% of the natural gas currently consumed in the EU, by 2050.[65]

60 Teresa Wójcik, *RAPORT: Czy światu zabraknie LNG?* BiznesAlert.pl, accessed 2 June 2022, https://biznesalert.pl/raport-czy-swiatu-zabraknie-lng/.

61 The methane content in biogas may range from 50 to 75%. Anneli Petersson, "Biogas cleaning," in: *The Biogas Handbook: Science, Production and Applications*, ed. Arthur Wellinger (Cambridge: Woodhead Pub, 2013), 329–34, https://doi.org/10.1533/9780857097415.3.329.

62 Alex J. Dunnett and Nilay Shah, "Prospects for Bioenergy," *Journal of Biobased Materials and Bioenergy* 1 (2007), 1: 1–18, https://doi.org/10.1166/jbmb.2007.1975.

63 Krzysztof Biernat and Izabela Samson-Bręk, "Przegląd technologii oczyszczania biogazu do jakości gazu ziemnego," *Chemik* 65 (2011), 5: 435–444.

64 *Biogaz w Polsce – raport 2022*, Magazyn Biomasa, accessed 30 June 2022, https://magazynbiomasa.pl/biogaz-w-polsce-2022-pobierz-za-darmo-nasz-raport/.

65 Ana Maria Jaller-Makarewicz and Arjun Flora, *Gas in Spain: Oversupplied and Overcompensated. High Premium Paid by Customers for Security and Diversity of Supply* (Institute for Energy Economics

Poland's biogas potential is hidden in the wealth of unused organic waste, such as from agricultural production, animal husbandry as well as from sewage sludge and landfills.[66] The environmental and economic characteristics of Poland clearly indicate bioenergetics as a potential area of technological specialisation of our country. The first premise is the strongly agricultural character of Poland, as agricultural land covers over 40% of the country's territory. It should be noted that out of nearly 14.7 million ha constituting the total area of agricultural land used for economic purposes in 2019, 10.9 million ha were used for agrarian purposes.[67] There is, therefore, a large amount of space that can be used for the cultivation of biogas plants, without prejudice to the existing crops.

At the end of 2021, there were approximately 350 biogas plants in operation in Poland,[68] which per number of inhabitants was the weakest result in the EU. Out of all installations, 219 are facilities operating in landfills or at sewage treatment plants. The remaining ones are agricultural biogas plants, where nearly 90% of biogas production was based on waste from food processing. The remaining part of the raw materials used came from special purpose crops.[69] According to the national guidelines for energy, by 2020, on average, in each of nearly 2.5 thousand municipalities one agricultural biogas plant was to be built.[70] This goal has not been achieved so far, inter alia, due to delays in the legislative process, which resulted in difficulties in obtaining sources of financing from banks, suspension of building permits, as well as protests of the population in the locations of planned investments.[71]

In Poland, biogas plants with a capacity of approximately 1 MW are the most numerous. The investment budget for the construction of such a biogas plant is close to EUR 4 million.[72] The operating period of the biogas plant is estimated at about fifteen years. As economic practice shows, despite the possibility of selling surplus electrici-

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and Financial Analysis, September 2021), accessed 17 June 2022, http://ieefa.org/wp-content/uploads/2021/09/Gas-in-Spain-Oversupplied-and-Overcompensated_September-2021.pdf.

66 Ilona Olsztyńska, "Biomass in the fuel mix of the Polish energy and heating sector," *Polityka Energetyczna – Energy Policy Journal* 22 (2019), 3: 7–9, DOI: https://doi.org/10.33223/epj/111916

67 Ibidem.

68 The number of biogas plants in the EU is estimated at approximately 19 thousand. See: *Biogaz w Polsce – raport 2022*.

69 Adam Juszczak and Magdalena Maj, *Rozwój i potencjał energetyki odnawialnej w Polsce* (Warszawa: Polski Instytut Ekonomiczny, grudzień 2020), accessed 3 July 2022, https://pie.net.pl/wp-content/uploads/2021/04/PIE-Raport_OZE.pdf.

70 Polityka energetyczna Polski do 2030 r. Dokument przyjęty przez Radę Ministrów w dniu 10 listopada 2009 r. (Warszawa: Ministerstwo Gospodarki, 2009), 13–26.

71 Ewa Woźniak, "Stan biogazowni w Polsce," *Czysta Energia* 1 (2017): 54–55, accessed 14 May 2022, https://www.portalkomunalny.pl/plus/artykul/stan-biogazowni-w-polsce/.

72 *Branża: liczba biogazowni rolniczych rośnie w Polsce zbyt wolno*, Portal Komunalny, accessed 30 June 2022, https://portalkomunalny.pl/branza-liczba-biogazowni-rolniczych-rosnie-w-polsce-zbyt-wolno-432057/.

ty or heat from such an installation, this type of investment remains on the verge of profitability, despite the fact that the current provisions of the Polish Act on Renewable Energy Sources provide for support for cogeneration biogas plants (producing both heat and electricity).

As of the beginning of July 2022, Poland did not have a single biomethane plant, while in the years 2020–2021 in the EU the total number of biomethane plants increased by 50% to the level of almost 1 thousand. The largest number of such installations is located in Germany, France, the Netherlands and Scandinavia. In 2020, approximately 25 million MWh was produced (approx. 30 thousand Mwh, i.e. approx. 3 million cubic metres on average per one installation), i.e. approximately 2.57 billion cubic metres of biomethane in total.[73]

In the current legal status, there is no system support in Poland dedicated to plants producing biomethane intended for injection into gas networks. The legal regulations in force in Poland do not oblige gas distributors to purchase biogas or agricultural biogas produced in a biogas plant and introduced into the gas distribution network, nor do they define specific rules for settlements between a producer and such entities.[74] As at the end of August 2022, Poland also failed to adjust its national regulations to the RED II directive.[75] The above information indicates, on the one hand, the gap between the regulatory and financial support system, and thus the level of development of the biomethane production sector between Poland and good European practices (e.g. German), but on the other hand, they indicate the enormous development potential of the Polish energy sector in terms of this fuel.

PGNiG estimates that it can accept approximately 4 billion cubic metres of biomethane for use, which is a volume similar to the annual production of domestic natural gas. Such a plan would require the construction of approximately 2,000 biomethane plants in the next 10 years and capital expenditure of EUR 15 billion.[76] Considering the presented conditions, however, it seems unrealistic; therefore the implementation of 10% renewable gases in the Polish gas network by 2030, assumed in PEP2040, is also questionable.

73 Biernat and Samson-Bręk, "Przegląd technologii."

74 Juszczak and Maj, *Rozwój i potencjał energetyki*; *Branża: liczba*.

75 Directive (EU) 2018/2001, also known as RED II, allows consumers to produce their own electricity, either alone or as part of the energy community operating in the field of renewable energy, without unjustified restrictions. It also grants them the right to disconnect from inefficient heating and cooling systems and third-party access for suppliers of renewable energy and waste heat and cooling to district heating and cooling networks See: Directive (EU) 2018/2001 of the European Parliament and of the Council of 11 December 2018 on the promotion of the use of energy from renewable sources.

76 Magdalena Skłodowska, *Biometanownia w każdej gminie?* Portal Wysokie Napięcie, accessed 14 May 2022, https://wysokienapiecie.pl/31337-biometanownia-w-kazdej-gminie/.

Conclusions

The European gas crisis in 2022 destabilised the entire global natural gas market. In view of the global LNG shortage; in the short term, this means gas shortages in the EU during the winter of 2022/2023, while in the longer term the global market, will be confronted with a shortage of supply, high prices, and probably collapses in some regional markets. Ensuring gas supplies for the economy and the population is an element of building the national security of the state in the strategic dimension. This approach is determined by the lack of self-sufficiency of Poland in terms of natural gas extraction and the need to obtain most of the necessary raw material from foreign suppliers.

The problem of the security of the Polish gas market comes down to the development and adoption of optimal regulatory, organisational and technical solutions, guaranteeing end users uninterrupted access to infrastructure and fuel gas. The Polish state, being aware of the threats occurring on both of these levels, took a number of actions aimed at systemic regulation of the security of the energy market. In the light of the considerations presented in this text, they should be considered, at least in part, not only as too late, but also as still insufficient. At this point, the operational risk related to the Baltic Pipe gas pipeline project, which is crucial for ensuring the current and future gas safety of Poland, should be emphasised. In principle, the gas pipeline was supposed to balance the amount of gas obtained from Russia with its capacity. However, it is problematic that Baltic Pipe is not directly connected to the Norwegian Shelf, but (as previously indicated) is connected to the Euro Pipe II gas pipeline, the annual capacity of which is 24 billion cubic metres of gas. In the conditions of the drastic gas shortage in the European Union caused by the war, it is obvious that Poland will not be able to participate in the planned nearly 40% of Europipe II's capacity.

It is highly probable that the Polish energy sector will have to rely on an energy mix based mainly on hard coal and lignite for much longer than originally assumed. It is therefore important that Poland undertakes negotiation efforts to reform the mechanisms of the European Union's climate policy, so that it is possible to carry out a low-emission and ambitious transformation, contributing to the achievement of the EU goals, taking into account the temporary increased use of conventional generation capacities, without incurring excessive costs resulting from the climate policy. In the context of Poland's potential in the field of biogas production, it is also recommended to launch research programs for projects consisting in the development of technologies allowing to increase the share of decarbonised gases in distribution and transmission networks. It is also crucial to develop effective support mechanisms aimed at increasing the attractiveness of biomethane as an energy carrier.

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English version: Mark Atkinson

SUMMARY

Ensuring energy security is a complex process influenced by many factors. Decisions taken in this area are mostly of a strategic and political nature and cause serious consequences for the entire economy and society. Countries that want to take advantage of the achievements of civilisation, in the absence of their own adequately efficient energy fuel resources, are forced to import them. On the example of Poland, the following have been identified: the causes and level of dependence of the economy on natural gas, threats to the availability of this raw material and formal restrictions on its use as well as its substitutes and energy alternatives. The approach applied in the article is the rational approach to the energy policy issues, and factor analysis including system analysis were used. The authors verified whether the diversified supply of natural gas by sea and the use of biogas can ensure strategic security of supply with this raw material to Poland. The conclusions resulting from the considerations indicate that having the infrastructure necessary for the diversification of gas supplies is no longer sufficient to ensure Poland's gas security. In 2022, the objective deviation of natural gas on the international market also became a critical factor in this regard.

Dostawy gazu drogą morską i biogaz jako elementy zapewnienia bezpieczeństwa energetycznego na przykładzie Polski

Słowa kluczowe: bezpieczeństwo energetyczne, dywersyfikacja dostaw gazu, LNG, biogaz

STRESZCZENIE

Zapewnienie bezpieczeństwa energetycznego jest procesem złożonym, na który wpływa wiele czynników. Decyzje zapadające w tej sferze mają przeważnie charakter strategiczny oraz polityczny i rodzą poważne następstwa dla całej gospodarki i społeczeństwa. Kraje chcące korzystać ze zdobyczy cywilizacyjnych, przy braku własnych odpowiednio wydajnych zasobów paliw energetycznych, zmuszone są do ich importu. Na przykładzie Polski dokonano identyfikacji: przyczyn i poziomu uzależnienia gospodarki od gazu ziemnego, zagrożeń dostępności tego surowca i formalnych ograniczeń w zakresie jego wykorzystywania oraz jego substytutów i alternatyw energetycznych. W artykule zastosowano racjonalne podejście do problematyki polityki energetycznej, a także wykorzystano metodę analizy czynnikowej, w tym również systemowej. Autorzy dokonali weryfikacji, czy zdywersyfikowane dostawy gazu ziemnego drogą morską oraz wykorzystanie biogazu może zapewnić Polsce strategiczne bezpieczeństwo zaopatrzenia w ten surowiec. Konkluzje wynikające z podjętych rozważań wskazują, że posiadanie infrastruktury koniecznej dla dywersyfikacji dostaw gazu nie jest już wystarczające dla zapewnienia zabezpieczenia gazowego Polski. Krytycznym czynnikiem w tym zakresie stała się w 2022 r. również obiektywna dostępność gazu ziemnego na rynku międzynarodowym.

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