NEW CONCEPTS OF DIVERSIFICATION OF SUPPLY AND DISTRIBUTION OF NATURAL GAS IN POLAND

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ABSTRACT
The changing economic and political situation leads to serious consideration and renovation plans for the expansion and diversification of natural gas supplies to Polish. The use by some countries the supply of natural resources (natural gas) as a tool for political pressure, forced to take appropriate preventive action in order to maintain the flow of the economy. One of the key problems of the public debate is the issue of diversification of gas supply sources, understood both from the perspective of access to the infrastructure to diversify gas supplies as well as from the point of contract security of gas supplies to Polish. This article presents different concept to ensure the smooth functioning of the natural gas distribution system.

Key words: gas system, natural gas, diversification, energy safety.

ABSTRAKT
Meniace sa ekonomická a politická situácia vedie k vážnym úvahy a renovácie plány na rozšírenie a diverzifikáciu dodávok zemného plynu do poľštiny. Použitie niektorých krajinách dodávky prírodných zdrojov (zemný plyn), ako nástroj na vyvíjanie politického nátlaku, nútení prijať vhodné preventívne opatrenia, aby sa zachovala tok ekonomiky. Jedným z kľúčových problémov verejnej debaty je otázka diverzifikácie zdrojov dodávok plynu, pochopil a to ako z hľadiska prístupu k infraštruktúre k diverzifikácii dodávok plynu, rovnako ako z hľadiska bezpečnosti zmluvných dodávok plynu do poľštiny. Tento článok predstavuje inú koncepciu pre zabezpečenie hladkého fungovania distribučnej siete zemného plynu.

Kľúčové slová: plynárenskej sústavy, zemný plyn, diverzifikácie, energetickej bezpečnosti

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1 INTRODUCTION

Natural gas is, next to coal and oil, one of the main energy sources, affecting the energy security of the country and its level of economic development. It is also an important chemical raw material, having a number of advantages. First, in comparison to the other fuels of raw materials, natural gas is less disruptive to the environment. Sam natural gas and other hydrocarbon fuels burn without producing smoke, ash and soot, which contributes to the improvement of air pollution.

Secondly, it is possible to use natural gas using simple mechanisms of regulation and automating the supply to the users. Moreover, it does not require storage in end, which is connected with the lack of necessity to build local warehouses in the matter. Thirdly, natural gas, compared to solid fuels, has a higher efficiency of use, which contributes to lower energy intensity of the national economy [1].

The problem of diversification of energy supplies plays an important role Polish politics since the early 90s diversification of natural gas supply in this matter is one of the elements of national energy security. In the light of the provisions of the Act of 10 April 1997 - Energy Law., Energy security is defined as "the state of the economy allows to cover the current and prospective demand for fuel and energy in a technically and economically justified by the requirements of environmental protection" [2] and [3].

Diversification is a concept of management - consisting in differentiating eg suppliers, customers, markets, products and services, sources of financing, structure, operations (production), investment, risk, etc. [4]. Gaseous fuels, which is a strategic component of our economy require special care in the field of ensure continuity of supply. With regard to natural gas, but also other energy resources are essential in this matter two elements: first, the geographic element associated with the need to ensure the supply of natural gas from different geographical directions and regions; secondly, the element of infrastructure associated with the necessity of creating the technical infrastructure for transport of natural gas. Through diversification of gas supplies to Polish should be understood to guarantee and protect its supply of the different form and with different geographical directions, in an amount covering reported on the domestic market demand. This applies to both the supply of short-term and long-term and inextricably linked to the problem of security appropriate infrastructure solutions in this regard.

2 THE CURRENT SYSTEM OF NATURAL GAS SUPPLY TO POLAND

In 2012, total natural gas consumption in Poland amounted, according to the data obtained in the course of research conducted regular monitoring, more than 15.436 billion m^3. Gas supplies from abroad, in the amount of 11.266 billion m^3 were supplemented by gas coming from domestic sources at 0.4 billion m^3, which accounted for nearly 27% of the total supply of natural gas in the country. The total gas supplies from abroad in 2012. Included imports from the East 61), and intra-EU Community supplies from Germany and the Czech Republic, where a significant part of them were imports from the east, implemented within the framework of a long-term contract

signed in 1996. Between the Polish Oil and Gas Company (PGNiG SA) and OOO Gazprom Export. On the basis of this contract was purchased 9.017 billion m^3 of natural gas, which accounted for approx. 82% of the total imports of this commodity on Polish territory [5].

Import this was supplemented by those of Germany and the Czech Republic. Total volume of these deliveries, carried out in the framework of agreements reached 1.983 billion m^3, representing approx. 18% of total imports of gas on Polish territory. Detailed information about the structure of gas supply and domestic mining capacity in 2012. Shown in the following Table 1.

Table 1: Structure of gas supplies to Polish [5].

Specification	**The amount of gas** [bn m^3]
Import, including:	**10 999,950**
Contract "Yamal"	**9 017,324**
The acquisition of intra-EU:	**1 982,630**
a) Germany	1 426,932
b) Czech Republic	555,700
Domestic production	**4 317,270**
Gas storage (state variable inventories)	**481,280**
Purchase from domestic sources (supplies for PGNiG SA from domestic suppliers)	**129,680**

State administration body responsible among other things for "gas security" is the Energy Regulatory Office. His job is mainly the implementation of projects aimed at creating conditions for energy security, efficient and economical use of energy and fuels, the development of competition, the negative effects of forming monopolies, taking into account environmental conditions, obligations arising from the agreements and agreements and balancing the interests of suppliers and consumers of energy and fuels.

The national structure of the supply and marketing of natural gas is dominated by the company PGNiG SA The resources of the company lies approx. 98% of the market. Despite the high level of concentration resulting from the position of the PGNiG Group, the retail market there are also other entities, with a share of approx. 2%. These dozens of companies operates as a resale of purchased natural gas from PGNiG SA to end users. Purchased fuel is transported mostly through their own distribution networks. For the implementation of transmission activities are responsible two entities: SGT EUROPOL-Gaz SA (Transit Gas Pipeline System Europol Gaz SA) and OGP Gaz-System SA (Operator Gaz-System SA). EUROPOL-Gaz SA manages the Polish section of the gas pipeline "Yamal-Europe" with a length of 685 km, used for transmission of natural gas to Germany, as well as to supply natural gas to the Polish by two delivery points, located in Włocławek and Lwówek.

The activities of Gaz-System SA includes the management of the national transmission system. The company manages networks of high pressure, with a total length of 9 709 km. In most EU countries, the place of the wholesale trade in natural gas include gas exchange or trading hubs. Their existence based on the principles of purely market is of great importance for the functioning of the market. In Poland, the gas trade is realized only within the framework of bilateral contracts, and the form of the sale of gas through the stock exchange or hubs, although the take-importance in the Union, just does not work in Poland, so it is difficult to talk about the liquidity of the gas market in our country.

The most important gas contracts has Yamal contract. The result was the creation of a contract thread gas pipeline Yamal-Western Europe (665 km gas pipeline runs through the Polish territory). On the technological needs of the project is 1.3 billion provided m^3 of gas per year, the objective Poland during each year of the levy is 13-14 billion pipeline gas m^3[1].

The company OGP GAZ-SYSTEM SA, which is wholly owned Treasury is responsible for the security of supply of natural gas transmission networks. The company was registered on the list of enterprises of strategic importance for the national economy. In addition, it holds 100% stake in Polish LNG Sp. Ltd., responsible for the construction and use of liquefied natural gas terminal in Swinoujscie LNG [6] and [7].

Currently, Polish gas system includes 17.2 thous. km pipeline (of which 15.4 thous. km powered by highmethane gas and 1.8 thous. km fuelled with nitrogen-rich gas). In total gas system supplies more than 4 ths. localities, including 590 cities. Length of gas distribution pipelines is estimated at approx. 95 thous. km. The system is operated by 18 gas compressor stations, gas stations 1708 high pressure, 4 thous. reduction and measurement stations and 6 underground gas storage facilities. The system of natural gas supply uses 6.6 million individual customers and 164 thousand. companies, of which 291 are large industrial plants, having the greatest impact on domestic gas consumption. In 2008. Capacity of underground gas storage facilities amounted to approx. 1.7 billion m^3. In 2012. Storage capacity increased to more than 2.8 billion m^3 of natural gas [6].

3 THE DISADVANTAGES OF THE CURRENT SYSTEM OF NATURAL GAS SUPPLY FOR THE POLISH

Fundamental defects in the current system of Polish supply of natural gas has the structure of supply in terms of geographical directions. Data from the Ministry of Economy show that in 2008. almost 9.8 billion m^3 of natural gas was imported from the eastern direction, while only 0.9 billion m^3 of the directions of others (Germany, Czech Republic). With an annual consumption of natural gas at the level of 14.2 billion m^3, this means that 75.3% percent of the domestic demand for gas is imported, including 69% from the eastern direction. Therefore there is a need to diversify gas supplies to Polish with a few basic reasons.

Firstly, the end of the twentieth century. Poland had a contract for the supply of natural gas almost exclusively from Russia, which contributed owned by Russian companies a strong bargaining position in the Polish market. It is evident that at the

beginning of the XXI century, Poland is a country dependent on energy supplies from one country - Russia. This situation also applies to natural gas. In 2011, nearly 8 billion m^3 of domestic demand for natural gas has been covered by imports from Russia. The total domestic demand for natural gas (14.2 billion m^3) represents a total volume of the order of 49.7% [8]. It is true that Germany imports three times more natural gas from Russia than Poland, also Italy are largely based its economy on Russian gas supplies, and Finland hundred percent [9], but the experience of Polish neighbourhood with Russia indicate that the plane of political relations Polish-Russian relations were characterized by conflict and rivalry rather than the friendly cooperation. In this context, the Polish central location in the uniting Europe creates a real chance to find partners in neighbouring countries. Finalization of contracts for the supply of natural gas to Polish from various deposits of this material would provide a real opportunity to diversify supply [10].

Secondly, the structure of natural gas supplies to Polish - which was mentioned in the previous paragraph - can lead to interruptions in the supply of raw material to Polish. Examples in this matter provide cyclically occurring "gas crises", in particular concerning the transit of this material through the territory of Ukraine. In large part they cause a reduction in the supply of natural gas to large industrial plants, and consequently suffered economic losses as a result of a reduction in the level of production [2]. In this matter should be paid in addition to the possibility of the so-called. energy blackmail, where more than 20% of the raw material is imported from one supplier [7].

Thirdly, according to experts of the Ministry of Economy prolonged threat is the possibility of eliminating or reducing the role of Polish as a transit of natural gas to Western Europe. In this context, the problem associated with the construction of bypass roads within the Polish new gas transit and the increasing dependence of the EU on energy supplies from Russia.

Fourth, the share of natural gas in relation to solid fuels in the Polish energy balance in the coming years will gradually increase. Foster this process will be a few conditions:

- Social pressure to reduce greenhouse pollution by thermal power facilities, and industrial facilities;
- actions of local authorities in terms of initiatives for the construction of new and expansion of already existing natural gas distribution networks, especially in rural areas;
- progressive modernization of the industry, which will involve the application of modern technology, providing a high degree of efficiency of use and favorable conditions for the protection of the environment. In this matter will have a fundamental legal solutions related to the Polish in joining to the EU in 2004.;
- increase in demand for natural gas, not only in industry but also in the municipal and household.

These problems need to take immediate action, because the Polish energy security of supply of natural gas directly translate into the security of the entire state. Poland, as one of the most dynamically developing countries of the EU, cannot find the emergency supplies of such strategic importance to the national economy and national security. In this context it should be noted that the geographical location of Polish state

only guarantee self-sufficiency in terms of final demand for coal and lignite. These raw materials are mainly used in power generation, however, due to negative consequences for the environment and human health as well as their small part in the production of liquid fuels importance of these two raw materials in the Polish energy balance will gradually decline in the coming years. The President of URE, when issuing of concessions, inform the trader of the need to ensure the required degree of diversification of supply, according to the Council of Ministers of 24 October 2000. Concerning the minimum level of diversification of gas supplies from abroad [11]. The concessions issued shall bear a condition relating to the duty to diversify natural gas supplies. In light of the maximum share of imported gas from one country of origin in relation to the total volume of imported gas in a given year should not be higher than 70%.

Presently there are a number of concepts for the diversification of natural gas supplies to Polish. Each of the three concepts shown below has both its advantages and disadvantages. In terms of practical activities finalized the draft Polish-Ukrainian gas pipeline Ustilug-Zosin-Moroczyn on a combination of gas networks Polish and Ukrainian. The disadvantage of the project is its low bandwidth (17.5 million m^3 of gas per year) and the eastern direction of the supply.

In 2012. Domestic natural gas reserves were estimated at 93.3 billion m^3. It should be emphasized that the condition of natural gas resources is subject to constant change. Fundamental importance in this matter have work aimed at discovering new deposits of this raw material. In just the Baltic Shelf natural gas resources is estimated at 10 billion m^3, and the whole Polish zone of the Baltic Sea up to 100 billion m^3. In addition, documented geologically natural gas resources in the Polish Lowland and Podkarpackie is estimated at approx. 320 bilion m^3 [12]. Exploitation of national economic justification is appropriate, because the cost of extracting domestic natural gas are much less than the cost of gas imported from Russia (respectively 70 and $ 120 per 1 thousand. m^3). In the near future, however, it is not possible to increase the domestic production of natural gas over 6 billion m^3 per year, until it terminated the contract with Gazprom, concluded in 1996. Pursuant to this contract because of PGNiG would not be able to sell surplus raw materials imported on a „take-or-pay". The above situation is not conducive to efficient use of domestic resources of raw materials, because Poland is obliged to settle financial claims for contracted gas, regardless of whether you use the contracted amount. In the present should be a mention that this situation was slightly changed by negotiating an Additional Protocol to the contract. Under this Protocol, the amount of gas supplied by Gazprom to Polish have since 2003. Decreased by 26.2%. Thus, the decreased spending on gas imports from Russia compared to previous contractual obligations ($ 5 billion).

Among evaluated in the following section the concept does not take into account those projects that have remained dead, not diversify gas supplies or Poland does not participate in them (Amber, North European, Yamal II, Baltic Pipe, Sarmacja). In the above matter to assess the merits several projects: Nabucco, Interconnector Bernau-Szczecin and plans for gas imports from Norway. Nabucco gas pipeline is to be built by 2011. Companies from five countries: Austria, Bulgaria, Turkey, Romania and Hungary. For this purpose, established the entity responsible for the construction of the Nabucco Gas Pipeline International GmbH, based in Vienna. The pipeline will have a

length of 3300 km, the target capacity of 31 billion m^3 of natural gas annually, will be partly financed by the EU, and the ability to achieve operational in 2014. Project will be fully completed in 2019. Nabucco gas pipeline project has several advantages. First, by building a short, above-ground section of the pipeline from Austria Poland have obtained access to natural gas from non-Russian sources. Countries involved in the construction of the pipeline are so dependent on Russian gas supplies, it does not seem likely to agree to transport additional volumes of Russian natural gas to the pipeline. Second, join the Nabucco project could reduce gas imports from Russia (after 2022.) And increase the number of directions geographical sourcing of raw materials. Thirdly, the costs of participation in the company building the pipeline are relatively small (approx. 1 billion €) in relation to the possible benefits to gain access to the non-Russian sources of gas [13]. In turn, the major shortcomings of the project should include a substantial length of the pipeline and a large number of transit countries and the relatively high cost of the investment. What's more, a large number of transit countries may translate into increased purchase of raw materials, which can be further enhanced by the fact of political instability in the region of gas supply (the Caspian region, the Middle East, Central Asia). In addition, the Polish participation in the project is not a foregone conclusion. The construction of the interconnector between Germany and Polish (connection Bernau-Szczecin) would increase the number of connections with the countries of Western Europe. The project itself was to begin operation already operating in 2006., And ultimately this road was to be transported to the Polish 1.5 billion m^3 of natural gas per year. The main disadvantage of the project is that it does not zdywersyfikowałby on gas supplies to Polish, because the gas would be pumped from Germany Russian gas, and also much more expensive (transit fees in Germany). The main advantage of the project is, however, low cost construction of the pipeline (approx. 80 mln €). The importance of such projects would increase if the EU had a common energy policy. They constitute the role of "fuses" the gas system in presence of gas shortage in any Member State.

Concept of building a gas pipeline from Norway being planned already appeared in 2001. Pipeline with a length of approx. 1 thousand. km had run from the North Sea to the Polish Baltic Sea coast and constitute a joint venture company PGNiG and Statoil. The total capacity of the pipeline was to be 8 billion m^3, of which the Polish took a year getting 5 billion m^3 of gas. This concept does not seem to be at present justification. Construction of the pipeline would be a costly venture, Norwegian gas price higher than the price offered by Gazprom, and the technical parameters of Norwegian gas does not allow for injecting it into the gas transmission in Poland [14]. Gaining access to the supply of Norwegian gas would, in the current situation of real diversification of natural gas supplies, but would, in turn, the way in the use of surplus raw materials on the market in the event of the contract with Gazprom until 2022., And plans to build a gas terminal in Swinoujscie. Plans to build a gas terminal on the Polish coast were discussed at the government level since 2001., To finally, in the last four years, subject to instantiation. The construction costs of the above-mentioned gas terminal, serving reception of liquefied natural gas (LNG - liquefied natural gas) and the purchase of the fleet transports are estimated at approx. 750 mln €. The entity responsible for the construction and use of liquefied natural gas terminal in Swinoujscie LNG is a company Polish LNG Ltd. [10].

The concept of supply liquefied natural gas to Polish has a number of advantages. First, the construction of a gas terminal allows for real diversification of sources of gas, and not just road transport. Therefore, it seems possible to gain access to suppliers of natural gas from Egypt, Algeria, Qatar, Libya, Nigeria and Norway. Second, the modular design of technical systems allows you to adjust the capacity of the liquefied natural gas to the real needs of the domestic market (from 2.5 to as much as 7.5 billion m^3 of natural gas per year). Thirdly, liquefied natural gas investments are proven in practice in the United States, Europe, and Asia. For example, it should be noted that by the LNG terminal Spain performs 17.5% of the domestic demand for natural gas. Fourthly, the use of liquefied natural gas is considered a technology much more safer than compressed gas, and LNG is considered better quality than the raw natural gas from Russia. In addition, LNG is regarded by environmentalists for fuel fully organic. Fifthly, the LNG terminal does not stop its operations in the event of exhaustion of domestic natural gas reserves [7] and[10].

In terms of the shortcomings of the above concept is noteworthy that the LNG prices are much higher than the prices of gas imported from Russia. The costs of extraction and transportation of LNG in this matter are lower than the corresponding cost of production and transportation of Russian gas, but in the case of LNG, they are increased by the cost of gas liquefaction, storage, shipping, discharge in gazoporcie, regasification and distribution to final consumers. In this aspect, only the cost of liquefaction and gas storage are approx. 20-45% of the final price. Moreover, in the coming years, the level of demand for LNG will increase in 2030. Supply of natural gas by LNG will surpass supply carried the traditional route of transport, or pipelines. Excess of demand over supply for LNG may impede contracting of supplies, because the same investment in the form of LNG terminal may be unintentional action if they are not protected in this matter the source of supply of raw materials on world markets. Secondly, the construction of the LNG terminal would necessarily require the outlay of the technical infrastructure on the land and the purchase of a fleet of ships to transport the gas.

On the report of the Polish Geological Institute (PGI) on shale gas resources in the pool Baltic-Podlasie-Lublin. According to estimates PIG gas resources in shale formations belt stretching from Pomerania to the Lublin area can be up to 1.92 trillion m^3, and the most likely range between 346 - 768 billion m^3. The report was based on the analysis of archival data from 39 exploratory holes made in the years 1950 to 1990. PGI plans to update its report after examining samples from 100 wells drilled on the area of Polish [15].

5. CONCLUSION

In summary we should pay attention to the fact that the diversification of energy supplies to Polish, including the natural gas should be a priority in the Polish energy security in the coming years. Actions taken by successive governments after 1990. Diversification of natural gas supplies assumed to take into account a number of more or less justified politically and economically concept. It should be noted that the primary emphasis in this matter should be placed on diversifying the geographic regions of origin of the raw material.

At the moment, the most optimal and economically justifiable concept is the decision to build the LNG terminal in Swinoujscie. In this regard it is noted a few facts. Firstly, construction technology and use of LNG terminals has already been sufficiently tested in practice. Second, the amount of gas that Poland could import using gas terminal (from 2.5 to 7.5 billion m^3 of natural gas per year) would in 17,6-52,8% cover domestic demand for gas.

Thirdly, the large spread in the field of gas imported by the gas port (up to 5 billion m 3) allows you to adjust the supply of raw materials, depending on the demand in the domestic market.

LNG Terminal is the more optimal solution that regardless of whether Poland uses the contracted amount of gas from Gazprom, is 2022. Obliged to pay for it on a „take-or-pay". Adverse purchase rules, as amended in part by the Additional Protocol to the Yamal contract mean that Poland must avoid a situation in which the domestic market there would be a surplus purchased, but unused gas. Unfavourable rules affect the Yamal contract inefficient exploitation of domestic. In this matter, however, should pay attention to the fact that national resources should be treated as a strategic reserve, used only in situations of shortage of raw material from foreign sources. The primary role should therefore research in this area in the search for new deposits, as well as projects for the construction of infrastructure for natural gas storage.

In turn, the concept of Bernau-Szczecin gas pipeline, however well judged by experts due to the low cost of investment, can`t be a priority at the moment at least two reasons. First, it creates a real diversification of gas supply in terms of its origin. Second, in the absence of a common EU energy policy can`t function as a "fuse" the gas system, which was mentioned earlier. The next two projects Nabucco it seems be a viable alternative to Russian gas. In his favour is justified by the fact of real change in the source of supply of raw materials and the determination of countries involved in the project in terms of its final implementation.

Important from the point of view of environmental policy and waste management is the expansion of the network of biogas plants. Factor abstention development of this element of diversification of gas supplies is primarily a lack of regulations (the Act) on renewable energy and the lack of a coherent policy of our country in support of the industry.

At the conclusion one could add that the last results of studies conducted in depleted coal also give hope to increase the efficiency of the coal gasification process, which can get a significant amount of gas.

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Článok recenzovali dvaja nezávislí recenzenti.