Current Use of Natural Gas within the European Union

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Abstract— *In connection with the heated political situation to the east of the European Union (EU) borders, there is a growing interest in the discovery of new reserves of natural gas or new suppliers of this fossil fuel. The following article discusses the current suppliers of natural gas to the EU, the energy self-sufficiency of the EU and the possibility of transporting natural gas in the form of LNG.*

Keywords— natural gas, REPowerEU plan, liquified natural gas (LNG), H2 pilot project, floating storage of natural gas.

I. INTRODUCTION

The current political situation requires new and unconventional ways of solving the storage and transportation of natural gas in large quantities and over long distances.

II. CURRENT NATURAL GAS SUPPLIES TO THE EUROPEAN UNION

In response to the difficulties and disruption of the global energy market caused by Russia's invasion of Ukraine, the European Commission started implementing the REPowerEU plan in May 2022. Thanks to the REPowerEU plan, the states of the European Union succeed in diversifying their energy supplies, especially [1]:

- Conclusion of agreements with other third countries on the import of gas through the gas pipeline,
- Investment in the joint purchase of liquefied natural gas (Fig. 1),
- Securing strategic partnerships with Namibia, Egypt, and Kazakhstan to guarantee safe and sustainable supplies of clean hydrogen,
- Signing of agreements with Egypt and Israel on the import of natural gas to Europe

FIGURE 1: Transportation of LNG by tanker [2]

Most natural gas supplies to the EU are currently routed via pipelines from Norway and tankers from the US in the form of LNG. In the summer, the key supplies were mainly liquefied natural gas (LNG) by sea and pipeline gas from Norway (Fig. 2).

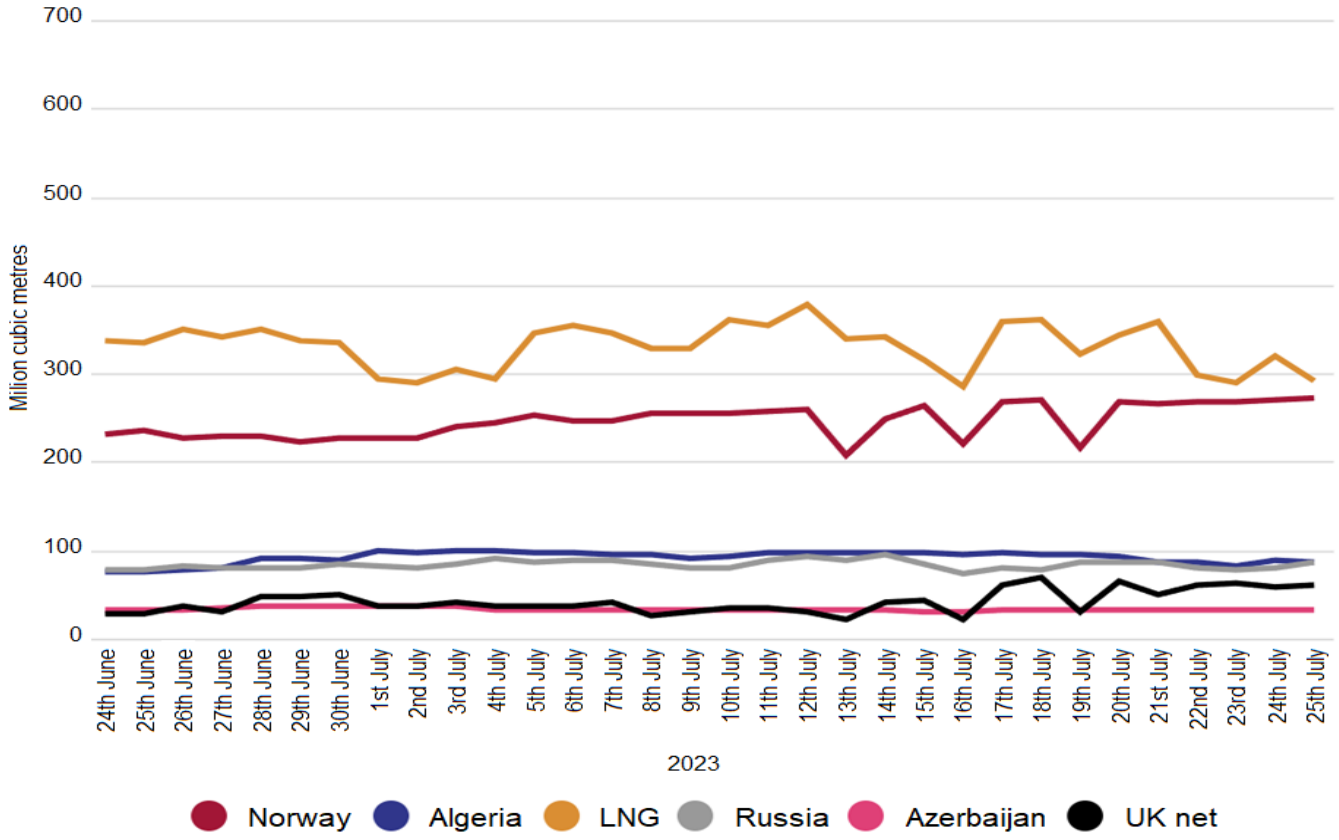

FIGURE 2: Daily NG supplies to EU countries in cubic metres (from 24th of June to 25th of July 2023) [3]

III. ENERGY SELF-SUFFICIENCY OF THE EU

There is no miracle solution that could reduce the EU's dependence on the import of natural gas from Russia. It was possible to achieve a gradual reduction of gas imports from Gazprom by combining various approaches and solutions.

According to the Europe Gas Tracker Report 2022, infrastructure investments amounting to EUR 48.5 billion are needed for the complete replacement of Russian gas with LNG. Of this, 12.3 billion are costs for the completion of terminals and 36.3 billion are costs for the completion of networks. It is already evident from these figures that a full replacement is not possible in the foreseeable future.

In March 2023, the EU tightened its rules to increase the capacity of energy from renewable sources. The binding EU target by 2030 has thus increased to 42.5 % with the ambition to reach 45%. This would almost double the share of renewable energy in the EU.

The European gas industry is trying to green the molecules of transported gases. Bio or synthetic methane are comparable in properties to natural gas.

However, hydrogen, potentially a much more significant player in the field of renewable and low-emission gases, presents far greater challenges for the traditional gas industry due to its different physical and chemical properties.

Ongoing initiatives in Europe have the common goal of establishing a maximum safe limit for the volume percentage of hydrogen in the mixture distributed with natural gas (20 – 30 % vol). The reason is to maximize the use of hydrogen from renewable sources without further treatment, as a substitute for fossil natural gas.

When replacing natural gas with other renewable sources, one of the goals of the European Union is to produce 35 billion cubic meters of biomethane by 2030 in Europe. This would correspond to roughly 10 to 12 percent of annual consumption. Through the supply of bio CNG and bio-LNG, it will be possible to significantly decarbonize, for example, public transport.

The hydrogen should also have a significant impact on the decarbonisation of the EU – it is mainly green hydrogen, which is produced from energy from renewable sources through the electrolysis of water.

From the point of view of the gas industry, the biggest challenge is the preparation and adaptation of the gas infrastructure for hydrogen. Because it is three times lighter than methane, which is the main component of natural gas.

Last year, a project called H2pilot took place in the Slovak Republic. It is a project of testing the mixing of 10 % hydrogen into natural gas in the Slovak village (Blatná na Ostrove).

FIGURE 3: H2 Pilot - DSO 10% Hydrogen blending project in Slovakia [6]

IV. LIQUEFIED NATURAL GAS

Liquefied natural gas, or LNG, is natural gas that has been converted into liquid form for ease of storage or transportation by cooling the natural gas to approximately -162°C. It is then stored at atmospheric pressure. Liquefied natural gas is transported by tankers to national gas transmission systems and then through distribution pipelines to consumers.

LNG occupies approximately 600 times less volume than gaseous natural gas, which is its main advantage for storage and transport. LNG is made up of 90 – 100 % methane and, depending on the mining area, also contains residues of ethane, propane, higher hydrocarbons, nitrogen, and other gases. Its calorific value is around 55 MJ per kg, expressed in litres it is about 22 MJ per liter. The flash point of LNG is 540 °C. Before the natural gas is liquefied, it is necessary to remove the undesirable components. The permissible amounts of these undesirable components are shown in tab. 1.

TABLE 1
PERMISSIBLE AMOUNTS OF UNDESIRABLE COMPONENTS IN LNG [7]

Component	Unit	Maximum permissible amount
Water	ppm vol. *1	1
Carbon dioxide	ppm vol.	1000
Sulfur compounds	mg/Nm^3 *2	30
Mercury	mg/Nm^3	10
Aromatic hydrocarbons	ppm vol.	10

1 ppm vol. means one volume part per million,
2 mg/Nm³ means milligram per normal cubic meter (under normal conditions – 101 325 Pa and 0 °C)

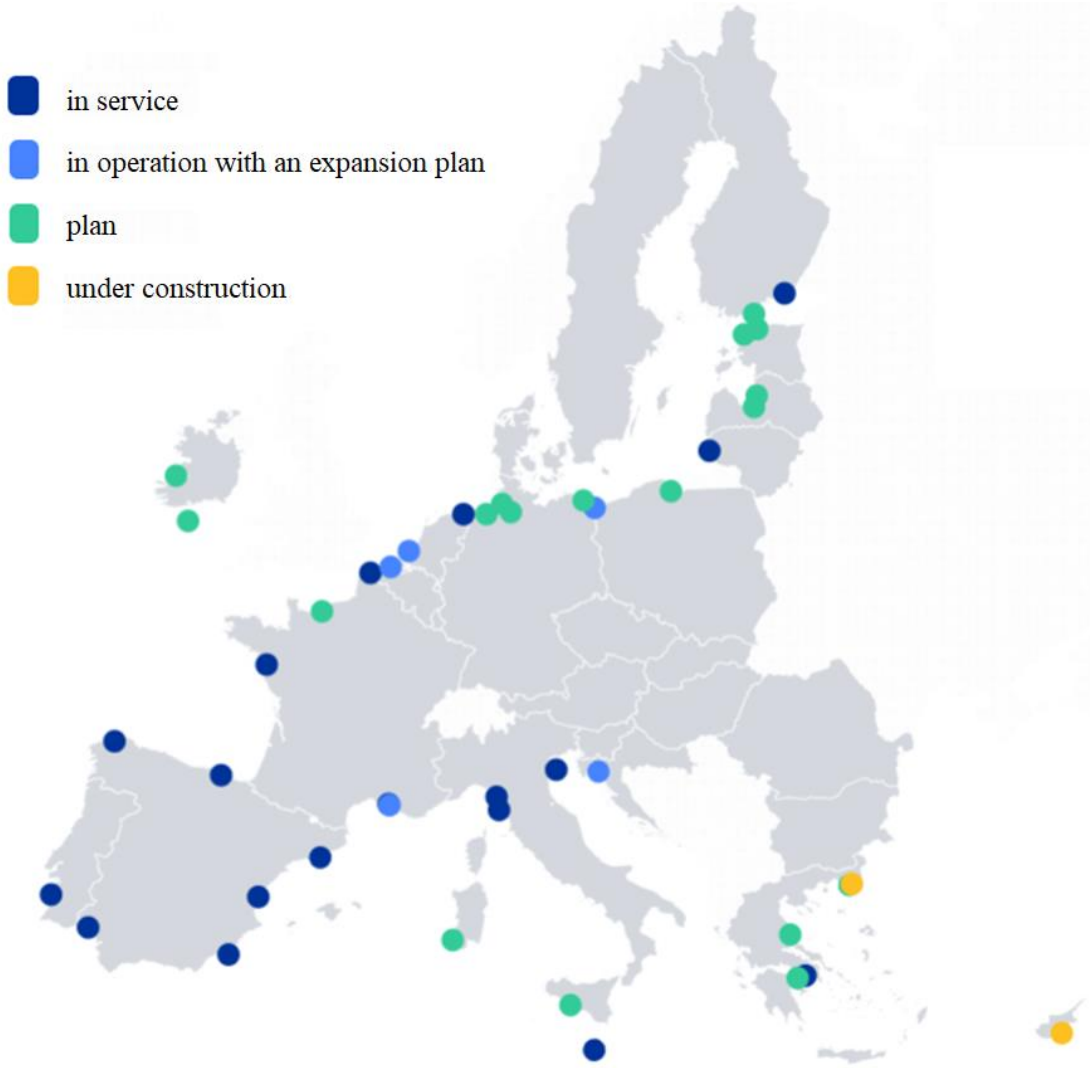

FIGURE 4: LNG infrastructure in the European Union [8]

The largest ship for transporting liquefied natural gas was presented at the end of April this year in Shanghai, China. The developer of the vessel is the Chinese company Jiangnan Shipyard. The vessel has a transport capacity of 93,000 cubic meters of raw material.

The ship named Harzand is 230 meters long and 36.6 meters wide. Harzand is fuelled by liquefied petroleum gas (LPG) and is supposed to meet the latest greenhouse gas emission regulations [9].

Large-capacity LNG terminals (Fig. 5) are located on the coast or as floating facilities (Floating Storage and Regasification Units - FSRU), which enable the arrival of LNG tankers and subsequently transform LNG into natural gas.

Importing liquefied natural gas is a way to diversify the suppliers and routes the EU uses to obtain natural gas.

In the first half of 2022, the United States became the largest supplier of LNG to the EU, covering almost 50 % of total imports. The import of LNG from the USA has more than doubled year-on-year.

The total capacity of the EU to import LNG is considerable (approximately 157 billion m^3 per year in the form of liquefied gas re-converted to a gaseous state) - enough to meet approximately 40% of the total demand for gas. However, access to LNG infrastructure is uneven within the EU [8].

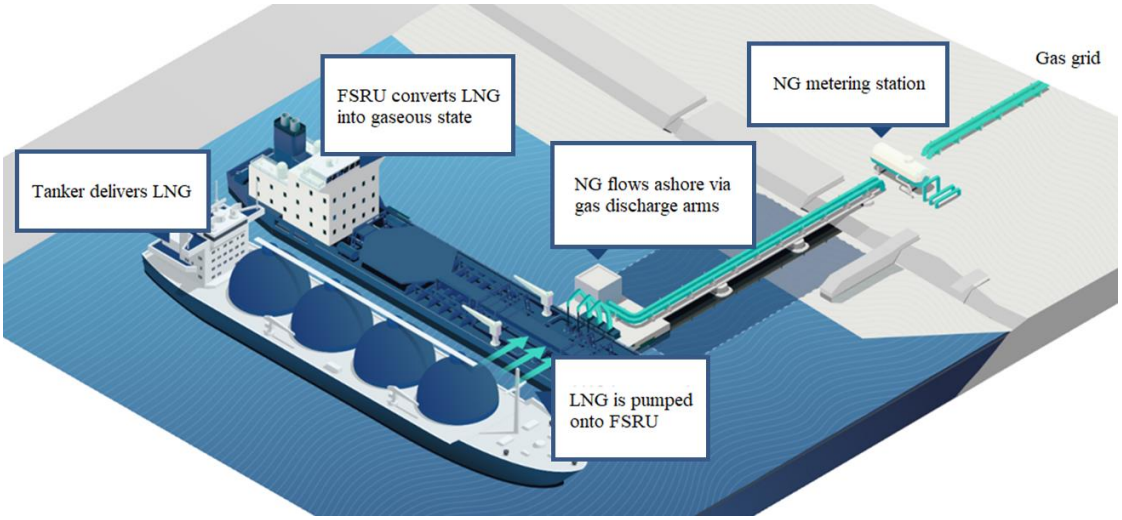

FIGURE 5: Floating Storage and Regasification Unit (FSRU) [10]

V. CONCLUSION

Natural gas is a fossil fuel. Although its combustion produces significantly fewer CO_2 emissions than, for example, in coal-fired power plants. However, during the extraction and transportation of natural gas, a much more dangerous greenhouse gas, methane, is released.

The latest summary report of the International Panel on Climate Change warns that to keep global warming within safe limits, it is necessary to stop any new investment in fossil fuel projects.

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