ALTERNATIVES FOR THE EUROPEAN UNION'S NATURAL GAS DEPENDENCY ON RUSSIA

A THESIS SUBMITTED TO
THE GRADUATE SCHOOL OF SOCIAL SCIENCES
OF
MIDDLE EAST TECHNICAL UNIVERSITY

BY

KAAN KALAFAT

IN PARTIAL FULFILLMENT OF THE REQUIREMENTS
FOR
THE DEGREE OF MASTER OF SCIENCE
IN
THE DEPARTMENT OF EUROPEAN STUDIES

JANUARY 2023

Approval of the thesis:

ALTERNATIVES FOR THE EUROPEAN UNION'S NATURAL GAS DEPENDENCY ON RUSSIA

submitted by **KAAN KALAFAT** in partial fulfillment of the requirements for the degree of **Master of Science in European Studies, the Graduate School of Social Sciences of Middle East Technical University** by,

Prof. Dr. Sadettin KİRAZCI
Dean
Graduate School of Social Sciences _____

Assoc. Prof. Dr. Başak KALE LACK
Head of Department
Department of European Studies _____

Assoc. Prof. Dr. Zerrin TORUN
Supervisor
Department of International Relations _____

Examining Committee Members:

Assoc. Prof. Dr. Oktay FIRAT TANRISEVER (Head of the Examining Committee)
Middle East Technical University
Department of International Relations _____

Assoc. Prof. Dr. Zerrin TORUN (Supervisor)
Middle East Technical University
Department of International Relations _____

Assoc. Prof. Dr. Burak TANGÖR
Hacettepe University
Department of International Relations _____

I hereby declare that all information in this document has been obtained and presented in accordance with academic rules and ethical conduct. I also declare that, as required by these rules and conduct, I have fully cited and referenced all material and results that are not original to this work.

Name, Last Name: Kaan KALAFAT

Signature:

ABSTRACT

ALTERNATIVES FOR THE EUROPEAN UNION'S NATURAL GAS DEPENDENCY ON RUSSIA

KALAFAT, Kaan
M.S., The Department of European Studies
Supervisor: Assoc. Prof. Dr. Zerrin TORUN

January 2023, 136 pages

Even after the withdrawal of the United Kingdom, the European Union -as a single market- is still among the biggest economies in the world. However, retaining and expanding this economy is a big hurdle to tackle due to the dependency on ever-decreasing natural resources on the continent that fuel it. Therefore, there have been attempts made by the Union to sustain its resource demand for the duration of transitioning to renewables. One such attempt is the usage of natural gas as a stopgap energy source until this transition is complete. Although the European Union is not internally self-sufficient in said natural gas, there are still some benefits for its utilisation with perhaps the biggest one being having a lesser ecological footprint when compared to other carbon-based resources.

The usage of natural gas also brings the question of whether the European Union can eliminate its dependency on its biggest partner, Russia. Since the relationship between the two is historically tumultuous and the recent conflict flaring between Russia and Ukraine has pushed this question to the forefront.

This thesis thus, aims to identify the actions of the European Union in the field of both liquefied and the natural gas. It will look through the infrastructure capabilities

in both LNG as well as natural gas pipeline sectors to come up with an evaluation for the viability of EU's achieving its energy independence specifically from natural gas imports from Russia.

Keywords: Natural Gas; European Union; Pipelines; LNG; Russia

ÖZ

AVRUPA BİRLİĞİ'NİN RUSYA DOĞAL GAZI BAĞIMLILIĞINA ALTERNATİFLER

KALAFAT, Kaan
Yüksek Lisans, Avrupa Çalışmaları Bölümü
Tez Yöneticisi: Doç. Dr. Zerrin TORUN

Ocak 2023, 136 sayfa

Birleşik Krallık'ın ayrılmasına rağmen Avrupa Birliği – tek bir market olarak- dünyadaki en büyük ekonomilerden biri olmaya devam etmektedir. Fakat bu ekonomiyi korumak ve büyütmek, kıtada bulunan ve giderek azalmakta olan doğal kaynaklara bağımlılık yüzünden aşılması zor bir engel halini almış durumdadır. Bu yüzden Birlik tarafından yenilenebilir enerji kaynaklarına geçiş süresince kaynak talebini desteklemek için bazı hamleler yapılmıştır. Bu hamlelerin bir tanesi de doğal gazın bu dönüşüm süresi tamamlanana kadar geçici bir enerji kaynağı olarak kullanılmasıdır. Avrupa Birliği söz konusu doğal gazda kendi kendine yeterli olmasa da, doğal gaz kullanımının bazı faydaları vardır ve bunların belki de en büyüğü ise diğer karbon bazlı kaynaklarla karşılaştırıldığında doğal gazın daha az ekolojik ayak izine sahip olmasıdır.

Doğal gaz kullanımı, Avrupa Birliği'nin bu alandaki en büyük ortağı olan Rusya'ya bağımlılığını ortadan kaldırıp kaldıramayacağı sorusunu da beraberinde getirmektedir. Bu iki aktör arasındaki ilişkinin tarihsel olarak çalkantılı olması ve son zamanlarda Rusya ile Ukrayna arasında alevlenen çatışma bu soruyu ön plana çıkarmıştır.

Dolayısıyla bu tez, Avrupa Birliği'nin hem sıvılaştırılmış hem de standart doğal gaz alanlarında yapmış olduğu eylemlerini belirlemeyi amaçlamaktadır. Araştırma, AB'nin hem LNG hem de doğal gaz boru hattı sektörlerine bakarak özellikle Rusya'dan yapılan doğal gaz ithaline karşı enerji bağımsızlığını kazanma yönünde ölçüm yapmayı amaçlamaktadır.

Anahtar Kelimeler: Doğal Gaz; Avrupa Birliği; boru hatları; LNG; Rusya

To my precious family and loved ones…

ACKNOWLEDGMENTS

This research has taken a significant amount of time from my life to arrange and condense, and it would not have been possible without the contributions and guidance of my thesis supervisor Prof. Zerrin Torun, with whom I feel honoured to work.

I also would like to acknowledge Res. Asst. Nurdan Selay Bedir's unending support ever since the beginning of my studies at METU. As a person who changed his academic field, her knowledge and help throughout my education and the bond we achieved during the imbroglios is something I wish everyone to experience and will be thankful for the rest of my life.

I would like to thank the distinguished members of the thesis committee for their constructive contributions and their critical feedback on this research.

Finally, I would like to thank my family members Fatih, Mine and Salsa for their exceptional support and endless patience during this stressful period. I dedicate this work to them.

TABLE OF CONTENTS

CHAPTER 1

INTRODUCTION

While on the whole, natural gas is being hailed by many as the future safety net of energy production due to its low carbon footprint, lower rate of emissions and ease of use. However, a fog surrounding the topic still exists. This haze is the result of the confusing amount of questions surrounding the subject matter, such as: whether is it really safe or not?; does it have the capacity to become the new medium for energy transactions?; or how viable is it for achieving the EU's energy security? These questions underline the necessity of learning more about natural gas with its role and importance in the broader sense. The energy demand, the traded volumes, the usage of liquified natural gas and what they mean may lead to confusion for people before correctly assessing the possibilities of the said fuel.

The initial idea for this research work, therefore, is to study the grander scene in the natural gas sector and its accomplishments in the recent past to see and assess its trend in the near future in light of the current situation. This work, thus, will try to bring the reader up to speed with the developments in the natural gas sector and, specifically, the steps the European Union has taken in regard to the issue of Russia to observe how the actor reacted and responded to the historical shocks such as Gas Crisis of 2009 that occurred between Ukraine and Russia. As one of the main actors in the Gas Crisis, Russia, has also invaded Ukraine in 2014 and again in 2022. In the case of the conflict that occurred in 2014, Nitoiu argued that the reaction from the European Union indicated disunity between the member states in regards to their reaction towards Russia as the EU–Russia relations have not been addressed in a comprehensive manner since the end of the Cold War and further noted that this crisis

tipped the balance towards the conflict side of the cooperation/conflict dimension.[1] Schmidt-Felzmann incorporated this fragmented status of the member states into two camps. With influential and large countries in the West seeking enhanced relations on the one side, and others, mainly from Central and Eastern Europe, regarding Russia with its actions and gas cuts as a threat due to their history as a weak state on the other.[2] Bosse, however, points out that the second invasion of Ukraine by Russia has fundamentally changed the international system and touched on the consolidation of the camps by citing the member states reaching unanimity in agreement on sanctions on Russia and the protection of the Ukrainians.[3]

With European Union seeming to be united in their position towards Russia, a contentious issue of EU being highly dependent on Russia for its natural gas imports remains. It is important to know whether the EU can reduce this dependency on a country that disregards national sovereignty. Therefore, the primary research question for this thesis is as follows: How effectively can the European Union reduce its natural gas dependency on Russia?

The study has the characteristics of secondary-desk research and will examine both primary and secondary sources. The coverage ground will include, databases, reports, annual reviews, policy papers, articles and press releases. The International Energy Agency (IEA), Eurostat data, Gas Infrastructure Europe (GIE) and European Commission will be the primary sources of the thesis.

This research is organized as the following:

The second chapter will provide a global natural gas review which will be the foundation for clearing up the cardinal information regarding natural gas by looking

[1] Nitoiu, Cristian. 2016. "Towards Conflict or Cooperation? The Ukraine Crisis and EU-Russia Relations." *Southeast European and Black Sea Studies* 16 (3): 385-386. Accessed July 2, 2022. https://doi.org/10.1080/14683857.2016.1193305.

[2] Schmidt-Felzmann, Anke. 2011. "EU Member States' Energy Relations with Russia: Conflicting Approaches to Securing Natural Gas Supplies." *Geopolitics* 16 (3): 593. Accessed July 1, 2022. https://doi.org/10.1080/14650045.2011.520864.

[3] Bosse, Giselle. 2022. "Values, Rights, and Changing Interests: The EU's Response to the War against Ukraine and the Responsibility to Protect Europeans." *Contemporary Security Policy* 43 (3): 531–46. Accessed July 3, 2022. https://doi.org/10.1080/13523260.2022.2099713.

at the worldwide situation in 2019. It will explain and define natural gas, natural gas reserves around the globe, production and consumption rates, reserves to production ratio, the liquefied version of natural gas and illustrate the general natural gas traffic. Furthermore, the chapter will also explain the unconventional means of extracting natural gas. This inclusion is crucial for understanding the current situation involving the research topic as the United States, which significantly uses unconventional means to extract natural gas (shale/tight), has gained a significant boost in its production and a major role in the last decade according to the existing literature.

The third chapter will discuss the situation in the European Union with its ever-increasing dependency on natural gas. This branch includes two main sub-chapters. The first part will begin with the EU's gross inland consumption and the differentiation between final energy consumption and gross inland consumption. This differentiation is necessary as the usage of the two may lead to ambiguity during the dependency ratios. The study will then cover the natural gas imports and production of the European Union as a whole. Furthermore, it will explain the method for evaluating and addressing the gas dependency rates. This ratio will then be used for each member state respectively. Likewise, in this part, the research will examine the natural gas imports from the partner countries, which highlights the natural gas dependency trouble of the European Union towards Russia. The final part of the first section covers the infrastructure capabilities of the EU on how the previously mentioned imports are transferred and distributed. This coverage will include the main pipelines originating outside, the explanation of bi-directional capacities between the member states and the current level of their interconnection, and terminals for importing liquefied natural gas. The section will end with a general examination of the pipelines that do not originate from Russia and explain their capacities. Furthermore, the second part of the chapter will cover the recent developments occurring in the natural gas domain. It will begin by looking at the historical legal acts carried out by the EU in relation to this resource to show the change that happened in the union first. Secondly, the section will focus on the significant events that had a major impact on the global natural gas sector to give the necessary information on how the European Union responded to these events. The included events in this section are the contract between the United States and the

European Union in 2018, the COVID-19 Pandemic, the Price War between Russia and Saudi Arabia and the renewed Russian-Ukrainian War.

The fourth chapter of the thesis will list the possible alternatives for the European Union to break away from Russian imports. The selection of the alternatives resonates with the information located in the second and third chapters. Thus, examining the viability of each option can be accurately achieved. First, among the list, this chapter aims to inform about the possibility of the European Union increasing its general liquefied natural gas imports. This section will also cover the grander issue of the United States's natural gas experience as the unconventional method of extraction of natural gas is now constituting the majority of US domestic production. Thus, a deeper dive into the future prospect and the limitations of such a method will play a crucial role in the assessment portion. The second and third options are the plans for new pipeline projects that can have a meaningful impact on the overall dependency of the European Union. These are the Trans-Saharan Gas Pipeline (TSGP), recently commissioned the Baltic Pipeline, and the future possibility of expansion in the Caspian region. The last alternative will inspect the green or renewable initiative carried out by the European Union to reduce its overall demand for fossil-based fuel types. Recent inclusion of nuclear and natural gas sources to EU taxonomy regulation will also be covered in this part.

The fifth and final chapter of the research will state the findings and serve as a conclusion. It will answer the research questions and address the limits of the study.

CHAPTER 2

GLOBAL NATURAL GAS REVIEW

This research will begin by giving an extensive overview of natural gas from various sources to showcase the resource. The chapter will commence by explaining natural gas and its global figures in diverse aspects. Then, it will present its liquefied version, how it is exchanged, and lastly, cover the unconventional methods for its extraction.

2.1 Global Figures

Speight identifies natural gas as a product of decomposing animal and plant matter that resides in the crust of the earth.[4] These gases create energy which can be utilised in various applications such as producing chemicals or as a fuel source when ignited. The main component of natural gas is methane, which consists of four hydrogen atoms combined with a carbon atom (CH4).[5] The creation of natural gas requires a long time to be formed. Thus, any significant usage of the source can not be compensated in a short period of time, making it classified as a non-renewable source. The carbon-based nature also leads to the fossil fuel designation. However, according to the U.S. Energy Information Administration (EIA), the performance of natural gas is more satisfactory and acts as a better alternative to other fossil fuel sources due to its lower emission rate of carbon dioxide (CO2) to the atmosphere when used.[6] Indeed,

[4] Speight, James G. 2019. *Handbook of industrial hydrocarbon processes* Natural Gas. 2nd ed. Cambridge, MA, United States: Gulf Professional Publishing. p. 9. Accessed November 3, 2022.

[5] Foss, Michelle Michot. 2007. "Introduction To LNG". Houston: Center for Energy Economics. p. 7. Accessed November 3, 2022. Available from: https://bit.ly/3TmlfMl.

[6] "Natural Gas And The Environment - U.S. Energy Information Administration (EIA)". 2022. Eia.Gov. Accessed August 31, 2022. Available from: https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php.

natural gas holds an advantage by delivering fewer greenhouse gas (GHG) footprint throughout its lifecycle when compared to other fossil fuels.[7] It is, therefore, not surprising to witness this source utilized more across the globe. This is also evident in figure 2.1, where natural gas successfully increased its share in the world in terms of supplying energy from 1971 with 16% to fulfilling almost a quarter of the global energy supply in 2018.

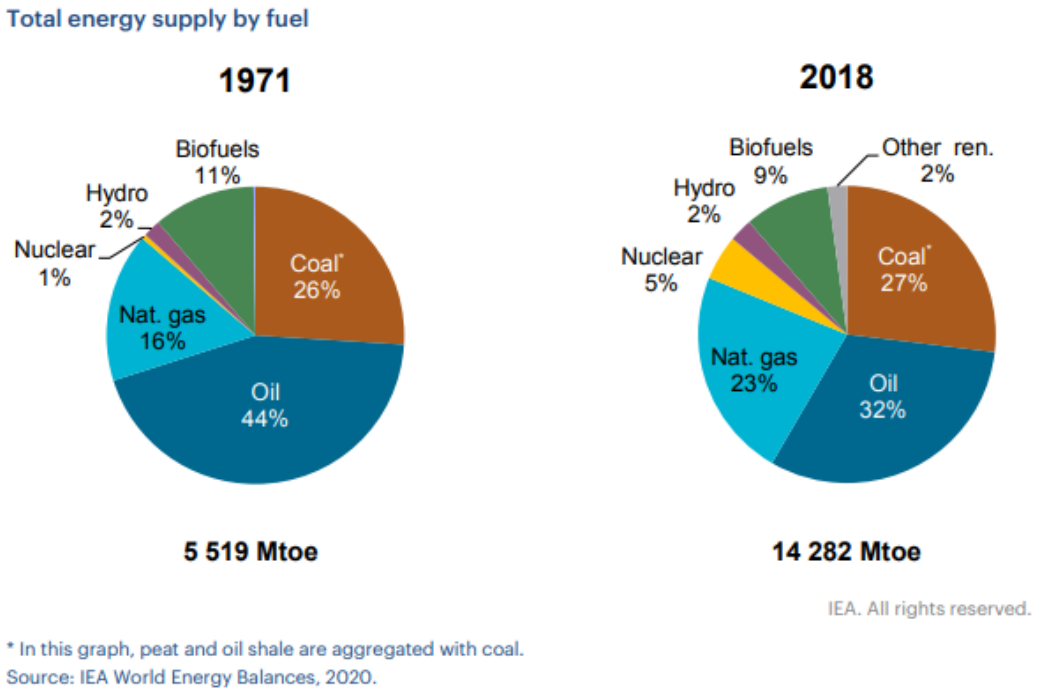


Figure 2.1: Total Energy Supply by Fuel

Source: IEA, 2020

Returning to the initial stage, the geological formations that hold the natural gas lead to two distinct categorizations for the reserves since the method required for the extraction depends on it changes accordingly. Since the chemical nature of natural gas is lighter than air, any significant natural gas reserve can only accumulate under the ground. With their access to the surface blocked by the impermeable rock formations, extraction of natural gas may only require simple drilling. If this is enough

[7] World Nuclear Association. 2011. "Comparison Of Lifecycle Greenhouse Gas Emissions Of Various Electricity Generation Sources". London: World Nuclear Association. p. 7. Accessed November 3, 2022. https://www.worldnuclear.org/uploadedfiles/org/wna/publications/working_group_reports/comparison_of_lifecycle.pdf.

for the gas to reach the surface, then the gas is in the "conventional" category. If the reservoir does not allow a sufficient amount of gas to leave just by drilling into it, which may happen due to gas formation showing granularity, then, it is classified as an “unconventional” gas.[8] These unconventional gas reserves require the usage of horizontal drilling and hydraulic fracturing technologies to be viably extracted. Therefore, exploitation of these resources are typically more costly than conventional method of extraction.[9]

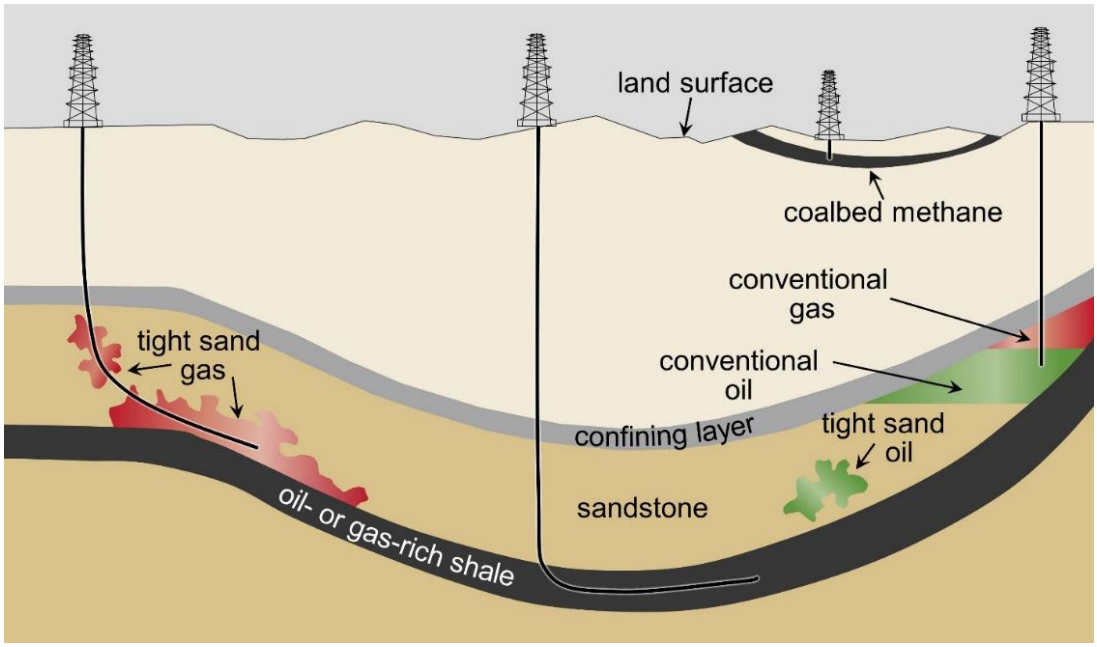


Figure 2.2: Conceptual Illustrations of Types of Oil and Gas Wells

Source: U.S. EPA., 2015

[8] NSW Environment Protection Authority. 2015. "Conventional And Unconventional Gas". Environment Protection Authority. p. 1 Accessed November 3, 2022. Available from: https://www.epa.nsw.gov.au/licensing-and-regulation/gas-industry/-/media/40b251dec4b44d378cc4ec56b7116602.ashx.

[9] Aguilera, Roberto F. 2014. “Production Costs of Global Conventional and Unconventional Petroleum.” *Energy Policy* 64: 134–40. p. 138 Accessed September 3, 2022. Available from: https://doi.org/https://doi.org/10.1016/j.enpol.2013.07.118.

2.1.1. Global Natural Gas Proved Reserves

For the sake of clarity, this thesis will try to cover the figures of natural gas volumes with the metric system as it is commonly used in monthly and annual calculations. Furthermore, the standards for the energy in natural gas differs from source to source as British Petroleum[10] (BP), International Energy Agency[11] (IEA) and U.S. Energy Information Administration[12] (EIA) use the gas volume at 15°C with a gross calorific value (GCV) of 40 MJ/m3 (megajoules per cubic metre) to define a standard cubic metres, whereas Russia (Gazprom) measures the gas volume at 20°C with a different pressure level, leading to IEA/RUS ratio of 1 = 1.017[13] to 1.07[14] bcm respectively. The European Union, on the other hand, uses 0°C as the reference point for volume at atmospheric conditions.[15] These details, although minute, can invariably lead to a difference in the statistics. Therefore, the author uses his discretion to use EU's and the IEA's given data as a basis due to its usage of the metric system as well as aligning with the most commonly used volume around the world.

In light of this preference, the proved reserves indicate the amount of supply of the resource that is commercially extractable with the current economic circumstances. This assessment utilises engineering and geological data from the

[10] BP. 2020. "Statistical Review Of World Energy". 2020. London. p. 36 Accessed October 13, 2022. Available from: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf.

[11] International Energy Agency. 2022. "Database Documentation". IEA Publications. p. 67. Accessed November 3, 2022. Available from: http://wds.iea.org/wds/pdf/gas_documentation.pdf. (May 2022 edition) Conversion factors from mass or volume to heat (Gross calorific value)

[12] "Frequently Asked Questions (Faqs) - U.S. Energy Information Administration (EIA)". 2021. Eia.Gov. Accessed November 3, 2022. Available from: https://www.eia.gov/tools/faqs/faq.php?id=45&t=8.

[13] "World Energy Outlook". 2011. Paris: International Energy Agency. p. 304. Accessed November 3, 2022. Available from: https://www.iea.org/reports/world-energy-outlook-2011.

[14] "Gazprom In Figures 2015–2019 Factbook". 2022. p. 4. Accessed May 31, 2022. Available from: http://gazprom.com/f/posts/72/802627/gazprom-in-figures-2015-2019-en.pdf.

[15] Commission Regulation (EU) 2015/703 CHAPTER III Article 13

known locations to reach a high degree of certainty.[16] The global total proved reserves for natural gas for the year 2019 stood at 198.8 trillion cubic metres, more than half of which are in the Middle East and CIS (Commonwealth of Independent States) countries. As seen in Table 2.1, the top 5 countries with the highest proved reserves in the year 2019 alone held 63.9% of the total amount.[17]

Table 2.1: Top Five Reserve Holders

Countries	Total proved reserves (tcm)	Share of the total amount
Russian Federation	38.0	19.1%
Iran	32.0	16.1%
Qatar	24.7	12.4%
Turkmenistan	19.5	9.8%
United States	12.9	6.5%

Source: BP, 2020

2.1.2. Global Natural Gas Production and Consumption

The global natural gas production for the year 2019 was around 3,989.3 bcm. The biggest producers of natural gas were the United States (23.1%), Russian Federation (17.0%), Iran (6.1%), Qatar (4.5%), China (4.5%) and Canada (4.3%) together, constituting 59.5% of the total natural gas production.[18]

Table 2.2: Top Five Natural Gas Producers

Countries	Production (bcm)
The United States	920.9
Russian Federation	679.0
Iran	244.2
Qatar	178.1
China	177.6

Source: BP, 2020

[16] Central Intelligence Agency. 'Crude Oil – Proved Reserves'. CIA, n.d. Available from: Accessed November 3, 2022. https://www.cia.gov/the-world-factbook/field/crude-oil-proved-reserves/country-comparison.

[17] BP. 2020. "Statistical Review Of World Energy". p. 32

[18] ibid. p. 34

On the other hand, in the year 2019, the world consumed around 3,929.2 bcm of natural gas. The highest demand came from the United States (21.5%), with Russia (11.3%), China (7.8%), Iran (5.7%), Canada (3.1%) Saudi Arabia (2.9%), Japan (2.8%), Mexico (2.3%) and Germany (2.3%) together reaching the 59.7% of the global consumption.[19]

Table 2.3: Top Five Natural Gas Consumers

Countries	Consumption (bcm)
United States	846.6
Russian Federation	444.3
China	307.3
Iran	223.6
Canada	120.3

Source: BP, 2020

2.1.3. Natural Gas Reserves-to-production (R/P) Ratio

Reserves-to-production (R/P) ratio is a simple tool to gather insight into how long a country can continue to carry on the amount of production at the current level. It is used by dividing the total reserves with the production of that year to see when the reserves will dry out with the current rate of exhaustion.[20] According to BP's 2020 report, the 2019 consumption rates, if stayed the same, will exhaust the remainder of the reserves in 49.8 years (BP 2020, 32).[21] Nevertheless, this does not mean the amount or the ratio will remain the same. While one can say that it shows a similarity with the proved reserve calculations, the reserves-to-production calculation can not anticipate diminishing returns from the existing fields. Furthermore, it also lacks foresight on the new discoveries or the usage of new technologies which may improve the extraction process.[22] Still, the reserves-to-production method can still give an insight for actors to plan ahead.

---

[19] ibid. p. 36

[20] BP. 2020. "Statistical Review Of World Energy" p. 32.;

Feygin, M, and R Satkin. 2004. "The Oil Reserves-to-Production Ratio and Its Proper Interpretation." Natural Resources Research 13 (1): 58. Accessed September 9, 2022. https://doi.org/10.1023/B:NARR.0000023308.84994.7f.

[21] BP. 2020. "Statistical Review Of World Energy". p. 32.

[22] Feygin, M, and R Satkin. 2004. "The Oil Reserves-to-Production Ratio and Its Proper Interpretation." p. 58.

For the United States, which was and still is the leading producer and consumer of natural gas (IEA, 2020/2021), the calculated remaining time with the current rate is 14 years. Russian Federation, the second-biggest producer, can maintain the current level of its production for the next 55.9 years at 2019 rates. For further information, figure 2.3 shows BP's R/P calculations for the regions.

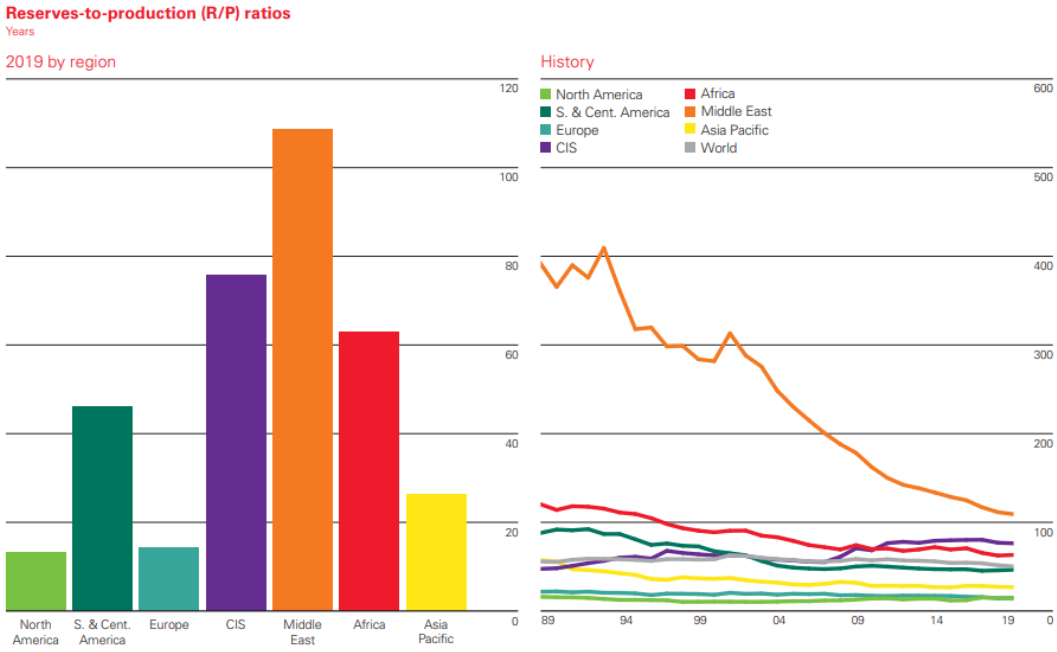


Figure 2.3: Global R/P Ratios for Natural Gas

Source: BP, 2020

2.2. Liquefied Natural Gas (LNG)

When natural gas is cooled down to the temperature of -161°C at the atmospheric pressure conditions, its form changes into a liquid. This condensation shrinks the volume of gas and, after the procedure, the new volume of the shrunk liquid-gas contracts to 1/600th of its natural state. This condensation makes the natural gas more viable for transport over long distances. The specialised tankers which can

retain the cryogenic conditions during their voyage can transport this new form of liquefied natural gas.[23]

The value chain for the LNG, seen in figure 2.4, comprises around 7 stages. The first stage is the extraction of natural gas which can be done by conventional and unconventional means and from both onshore and offshore locations. The second stage is the transportation of natural gas to the liquefaction facility. The third stage is where the gas will be cooled down to its liquid state thereby gaining the status of LNG. This sequence also has two options regarding the location of the liquefaction facility.[24] The process can be done in an onshore location via a liquefaction plant or in offshore floating production storage and offloading (FPSO) vessel. The latter, although more expensive, enables the extraction and the conversion at the same location, effectively eliminating the need for building offshore drills and pipelines back to the shore. Furthermore, should the need arises, it can also relocate to another place to continue its operations. The fourth stage is the transportation of LNG in specialised tankers to their destinations. Due to their ability to change course, these vessels can change directions during their voyage to another destination, which is a limiting factor for pipelines. The fifth stage is when these ships arrive at their destinations and transfer LNG into a regasification plant. The plant then, heats the LNG back to its gaseous form, the process of which is cheaper than liquefaction.[25] The following sixth and seventh stages are mainly about the transmission of the natural gas to the end-users where it will be used. These can be done via pipelines connected to a grid or trucks can be utilized.[26] If there is no need to reach the end-users, the regasification process can be halted and the LNG form can be retained at the plants or in storage sections where they can be kept for future use.

---

[23] Foss, Michelle Michot. 'Introduction To LNG'. Houston, 2012. p. 18. Accessed November 3, 2022. Available from: https://bit.ly/3SSme5y.

[24] Foss, Michelle Michot. 2007. "Introduction To LNG". p. 5.

[25] Kavalov, Boyan, Hrvoje Petrić, and Aliki Georgakaki. 2009. "Liquefied Natural Gas For Europe – Some Important Issues For Consideration". Luxembourg: European Commission Joint Research Centre. p. 11. Accessed October 12, 2022. https://publications.jrc.ec.europa.eu/repository/bitstream/JRC47887/eur%2023818%20en.pdf.

[26] Foss, Michelle Michot. 2007. "Introduction To LNG". p 6.

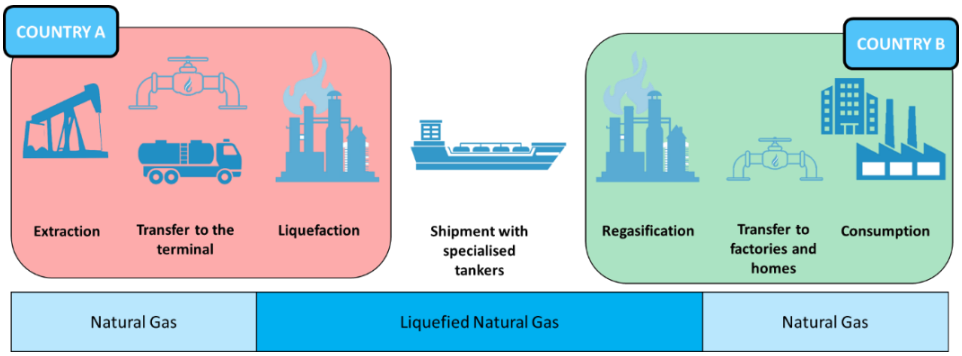


Figure 2.4: LNG Value Chain

Source: Author

The historical milestones for the commercial use of LNG go back to the 1960s. Indeed, LNG is not a new technology. The first commercial LNG liquefaction plant was constructed in 1964 in Arzew, Algeria. The first official LNG export, which happened between Algeria and the United Kingdom, occurred in the same year via a ship named Methane Princess (EIA 2014).[27]

2.3. Natural Gas Trade

The trade of natural gas occurs with two main methods. The first one is putting the natural gas into a pipeline and then transmitting it to the destination via pressure. The second one requires turning the natural gas into LNG and transporting it via shipping.[28] Although it is much cheaper to use pipelines as the LNGs' process complexity can be deducted from the previous section, there are some limitations to the usage of pipelines. Namely, the pipelines' rigidity in destinations is a significant factor. Moreover, the capacity of the infrastructure can create a bottleneck as well.

[27] EIA. 'June Marks 50th Anniversary of the First Commercial Liquefied Natural Gas Tanker'. *U.S. Energy Information Administration*, 19 June 2014. Accessed November 3, 2022. Available from: https://www.eia.gov/todayinenergy/detail.php?id=16771&src=email.

[28] Kidnay, Arthur J., William Rutledge Parrish, and Daniel G McCartney. 2019. *Fundamentals Of Natural Gas* Processing. 3rd ed. Boca Raton: CRC Press. Accessed October 1, 2021. https://doi.org/10.1201/9780429464942 p.415;

Mokhatab, Saeid, John Y Mak, Jaleel V Valappil, and David A B T - Handbook of Liquefied Natural Gas Wood, eds. 2014. "Chapter 1 - LNG Fundamentals." , 1–106. Boston: Gulf Professional Publishing. p.50. Accessed October 1, 2021. https://doi.org/10.1016/B978-0-12-404585-9.00001-5.

Another point to note is that the installation of the said infrastructure, which may cross the national boundaries, requires political tranquility between the countries and maintenance. By enabling trade in long distances and with its inherent flexibility in destination, LNG is helping the global gas market by increasing its liquidity.[29]

Nevertheless, the natural gas trade has been increasing over the years and according to the BP (2020) report that was released for 2019, the global natural gas trade has reached to 1,286.6 bcm. The total amount that was traded via pipelines stood at 801.5 bcm. whereas the amount of LNG volume covering the rest of the 485.1 bcm.

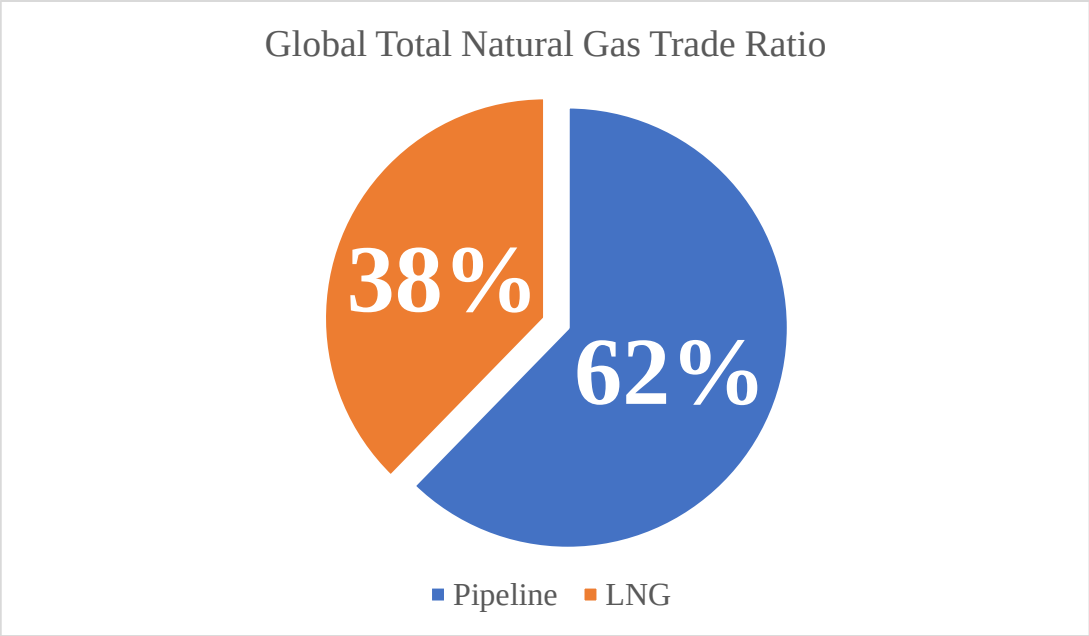


Figure 2.5: Global Total Natural Gas Trade Ratio

Source: BP incl. FGE MENAgas service, GIIGNL, HIS (2020)

[29] Zhang, Hai-Ying, Wen-Wen Xi, Qiang Ji, and Qi Zhang. 2018. "Exploring The Driving Factors Of Global LNG Trade Flows Using Gravity Modelling". Journal Of Cleaner Production 172: 508. Accessed September 9, 2022.https://doi.org/10.1016/j.jclepro.2017.10.244

2.3.1. Pipeline Trade

The use of pipelines to transport gas has a long history dating back to the last millennium BC, from the Greece to be perhaps used as a religious act to China where it was transported via simple bamboo pipes to boil water. Nevertheless, if one looks for the contemporary commercial utilisation of natural gas, then, they will conclude that it had gained traction from the 18th century and onwards as the cities adopted the natural gas –with the use of pipelines- to light up their cities. From then on, the invention of Bunsen burner paved the way forward for other applications for natural gas to be used for other purposes besides lighting.[30]

The limitations for the pipelines as mentioned in the last chapter are their capacity, since it cannot exceed the volume due to physical limitations, coupled with their requirement to be installed over countries that may not necessarily need the infrastructure -but necessary to be built across to reach the final destination-, and their unidirectional purpose. Be that as it may, the final reason does not necessarily eliminate the potential of its utilisation as pipeline hubs at the receiving end as they can be connected with other hubs, thus, creating a web of interconnected system. Yergin, points out that these pipeline links which exist in the EU were re-engineered to be able to send natural gas into both directions.[31]

For the year 2019, the largest export share belonged to Russia which, with its 217.2 bcm. export coincided with 27.1% of total amount. The second place belonged to Norway with its 109.1 bcm volume reaching 13.6%. The biggest importer from these two countries were the countries situated in the Europe with each exporting and supplying the continent with 188 bcm and 109.1 bcm of natural gas respectively.[32]

---

[30] Naturalgas.org. 'History', 2013. Accessed November 3, 2022. http://naturalgas.org/overview/history/.

[31] Yergin, Daniel. *The New Map: Energy, Climate, and the Clash of Nations*. 1st ed. New York: Penguin Press, 2020. p 85. Accessed October 11, 2022.

[32] BP. 2020. "Statistical Review Of World Energy". p 43.

2.3.2. LNG Trade

As Wood reasoned that, although the high material and operating costs coupled with the shortage of skilled workforce in the LNG industry kept the growth rates of the sector low, the prolonged persistent demand -coupled with gas prices in Asia and Europe remaining high- suggested that the capacity for LNG trade will have a reasonable growth for the long to medium term.[33] This suggestion also came with the fact that there was an increasing interest from many companies which wanted to tap and exploit the said potential.[34]

Since the LNG trade itself gives the companies a chance to improve their margins at every stage of the value chain, many firms have understood the importance of having the control of the infrastructure so as to not only getting a supplementary value during the monetisation, but also enhancing their flexibility in relation to switching cargo destinations to maximise their profit.[35] However, there are still issues that need to be covered to fully understand the basic economics of the LNG versus pipeline debate. The usage of pipelines to transport natural gas requires compressor stations to function. These compressor stations are built with 64 to 161 km[36] or 100 to 200 km[37] intervals to ensure that the natural gas retains its pressure during the transfer from one point to another. These stations can use the readily available natural gas from the system to power themselves and although, this might seem as a minute fact, the corresponding natural gas loss for the re-pressurisation is staggering. When we

---

[33] Wood, David A. 'A Review and Outlook for the Global LNG Trade'. *Journal of Natural Gas Science and Engineering* 9 (2012): 17. https://doi.org/10.1016/j.jngse.2012.05.002.

[34] Yergin. "The New Map: energy, climate, and the clash of nations." p. 38.

[35] Wood, David A. 'A Review and Outlook for the Global LNG Trade'. *Journal of Natural Gas Science and Engineering* 9 (2012): 17. Accessed November 3, 2022. https://doi.org/10.1016/j.jngse.2012.05.002.

[36] Naturalgas.org. 'The Transportation of Natural Gas', 2013. Accessed November 3, 2022. http://naturalgas.org/naturalgas/transport/.

[37] Göß, Simon. 'Tutorial Gas Market 6: Natural Gas Transportation and Storage'. Energy BrainBlog, 2017. Accessed November 3, 2022. Available from: https://blog.energybrainpool.com/en/tutorial-gas-market-6-natural-gas-transportation-and-storage/.

consider the example of long distances covered by the Russian pipelines starting all the way back from Urals to reach Western Europe, it is estimated that the loss of natural gas for this purpose reaches somewhere around ⅒ of total gas that has been transferred at the beginning.[38] This situation not only increases the cost of delivering natural gas to long distances via pipelines, but it also reduces the effectiveness of whole pipeline system compared to the LNG way of shipping. The breakeven for LNG trade becoming more cost effective resides at 1126 km for sea based pipelines; whereas it becomes more profitable to use LNG over 3540 km distance if the pipeline route is onshore. In below, the figure 2.6 is shared to better illustrate the idea of break-even ranges for the usage of LNG.

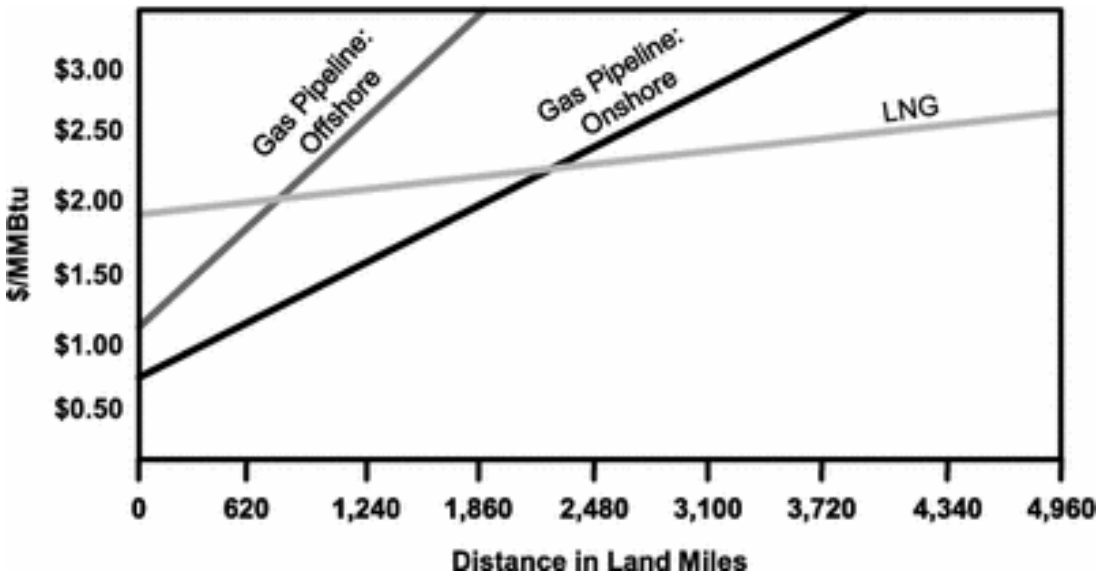


Figure 2.6: Natural Gas Transportation Costs

Source: Michelle Foss (2012)

Even with this information, the evolution of LNG trade is still, one of growth. The size of the LNG in natural gas trade has been increasing throughout the last decade. From its humble 249.7 bcm. level in the year 2009, it almost doubled its size in the year 2019.[39] This accelerated build up in capacity still owes its success to the long-term contracts even though the rise of medium and short-term -which is also

[38] ibid.
[39] BP. 2020. "Statistical Review Of World Energy".

called spot trading- sales are undeniable factors. The reason behind this issue is that the infrastructure for creating an LNG network, especially the aforementioned liquefaction stations, require substantial capital to be built; therefore, the long term viability for such projects require forward and long-term agreements to be commercially accepted by the investors to secure their investments.[40]

As far as the global LNG trade is considered, Asia retains the lionshare of the traffic with its highly fossil fuel dependent economies. There are many countries that possess no pipeline infrastructure for importation of the natural gas. For those that do, however, this phenomenon can partially be traced back to the pipeline length breakeven rate in comparison to the LNG imports. As countries such as Thailand and China which, do in fact have the capability to import via pipelines; for China in particular, the necessary long distance for the pipelines to cover means that the prices and tariffs for importing natural gas usually reach the same, if not beyond, the price of importing LNG.[41] The reversed role of the United States, which was thought to become one of importer markets, greatly enhanced the Asian and European consumers' expectations for improvements in supply and decrease in price as the country joined in the fray of exporter regions such as East Mediterranean and East Africa, paving the way for increased diversification and security of the resource. Therefore, as Wood pointed out, it is safe to add that the region will play a significant role in the upcoming decades.[42]

Table 2.4: Top Five Largest LNG Exporters

Countries	Exports (bcm) and global share
Qatar	107.1 (22.1%)
Australia	104.7 (21.6%)
United States	47.5 (9.8%)
Russia	39.4 (8.1%)
Malaysia	35.1 (7.2%)

Source: BP, 2020

[40] Wood, David A. 2012. "A Review And Outlook For The Global LNG Trade" p. 27.
[41] ibid. p. 25

[42] ibid. p. 27

2.4. Hydraulic Fracturing, Horizontal Drilling and the Shale Exploitation

To deepen the understanding of aforementioned role reversal of the United States in relation to natural gas, the role of hydraulic fracturing and horizontal drilling must be understood and acknowledged properly as they were the crucible for this tremendous change.

The usage of the fracturing dates back to the later part of the 19th century in the eastern part of the United States with the usage of nitroglycerin in liquid (and later solid) forms as an explosive material to tear apart the oil formations in order to increase both the access and even more recovery of the oil. This explosive usage for extraction –fracturing- was later implemented for gas and water wells with the similar amounts of success. Further experiments in the 1930s with nonexplosive liquids, mainly acids, paved the way for creating fractures that would not seal by themselves, therefore, leading to a productivity boost by effectively removing the extracted material. Usage of water injection was also found to be reaching the similar conclusions.[43] The usage and management of water during the unconventional extraction method, however, also creates a notable cost during the process.[44]

Referring back to the figure 2.1, there are two main definitions for the methods of extraction of natural gas and oil. The conventional method of extracting natural gas or other similar resources is achieved by vertically drilled wells. If the drilling is done in an horizontal axis, regardless of initial verticality, then this method is considered as an unconventional one. Application of horizontal drilling has been one of success as it has dramatically increased the productivity of fields up to two to five times in some cases due to the accessibility.[45] This effect, coupled with cost-reducing advancements

---

[43] Montgomery, Carl T, and Michael B Smith. 2010. "Hydraulic Fracturing: History of an Enduring Technology." *Journal of Petroleum Technology* 62 (12): 26. Accessed February 23, 2022. https://doi.org/10.2118/1210-0026-JPT.

[44] Zee Ma, Y. 'Chapter 1 - Unconventional Resources from Exploration to Production'. edited by Y Zee Ma and Stephen A B T - Unconventional Oil and Gas Resources Handbook Holditch, 35. Boston: Gulf Professional Publishing, 2016. Accessed November 3, 2022. https://doi.org/https://doi.org/10.1016/B978-0-12-802238-2.00001-8.

[45] Joshi, S D. 1988. "Augmentation of Well Productivity With Slant and Horizontal Wells (Includes Associated Papers 24547 and 25308)." *Journal of Petroleum Technology* 40 (06): 729–39. Accessed May 10, 2022. https://doi.org/10.2118/15375-PA.

in the field of horizontal drilling made it so that the fields that have been deemed commercially not feasible for further exploitation before can now be considered in the realm of future prospecting efforts.[46]

Gandossi and Von Estorff argue that while hydraulic fracturing method and horizontal drilling became prevalent in the world for their increased yields in hydrocarbon fields by themselves, the crucial change was the implementation of both techniques in a simultaneous manner especially in North America.[47] This was successfully proven to be effective in turning the shales in the United States commercially viable, hence, the rapid rejuvenation of carbon industry in the country.

2.5. Conclusion

This chapter explained natural gas and its exploitation methods to provide an introductory basis to establish a foundation. The chapter discussed the conventional and unconventional extraction methods and the differences they entailed. The chapter also explained the methods of transportation for natural gas and gave broad statistics on how the world conducted trade with these methods. This chapter has also briefly introduced the production and consumption rates of natural gas around the world. Furthermore, the chapter gave information on the proved reserves of the resource and explained the reserves-to-production ratio.

Overall, natural gas is classified as a fossil fuel and its impact on the environment is somewhat better than the other resources from the same family. Furthermore, the conventional extraction of natural gas and transportation of gas via pipelines prevail around the world with both options being cheaper to utilize. That said, the unconventional methods of extraction of the natural gas and transportation via LNG are also utilized to some extent. The United States, which will be explained in detail in the chapter 4 can be given as an example for a country that uses the

[46] Ishak, I B, R P Steele, R C Macaulay, P M Stephenson, and S M Al Mantheri. 1995. "Review of Horizontal Drilling." *Middle East Oil Show*. p. 391. Accessed February 23, 2022. https://doi.org/10.2118/29812-MS.

[47] Gandossi, Luca, and Ulrik Von Estorff. 'An Overview Of Hydraulic Fracturing And Other Formation Stimulation Technologies For Shale Gas Production', 2015. p. 7. Accessed November 3, 2022. https://doi.org/10.2790/379646.

unconventional method to obtain majority of its natural gas production. Similarly, the share of LNG in the global natural gas trade in 2019 was around 40% of the total. As the distance playing an important role on how the transportation of the gas can be conducted in an economic manner, this 40% ratio indicates a substantial importance of the LNG that cannot be underestimated.

The next chapter will shift the scope of the research towards the European Union and will try to explain its natural gas capacity, be it physical infrastructure or the legal background, in order to create an understanding that can be harmonised with this chapter's information.

CHAPTER 3

SITUATION IN THE EUROPEAN UNION

According to the World Bank's data, even after the United Kingdom's withdrawal in 2021, the European Union still had a gross domestic product value worth of 17.09 Trillion US dollars. This kind of size puts the entity into the third biggest economy in the world after the United States with its $22.9 T GDP and the People's Republic of China with its $17.7 T.[48] It is, therefore, imperative for us to delve deeper and understand how much of this leviathan-esque economy is sustained by the natural gas and how much of it is imported.

This chapter was planned to focus on only the natural gas as it is the main focus of the thesis; in doing so, it excludes other means for energy that the European Union utilizes for the sake of consistency in the main theme. In this regard, the following part will also include the converted value for energy in billion cubic meters of natural gas instead of widely used oil equivalent. The conversion method, as sourced on the footnote, uses multiplication by 1.226 to convert a million tonnes of oil equivalent (Mtoe) to reach a billion cubic metres (Bcm) of natural gas.[49] It is, however, subject to yearly change as the quality of natural gas may change this equation. For approximation, BP uses 1.163 to do the previous calculation.[50] Nevertheless, this rate also does not coincide with 2020 rates. Therefore, it should only be regarded as a

---

[48] This data is available on the official website of World Bank which can be reached at: The World Bank. 'GDP (Current US$)'. The World Bank, n.d. Accessed November 3, 2022. https://data.worldbank.org/indicator/NY.GDP.MKTP.CD.

[49] 1 Million tonnes of oil equivalent (Mtoe) = 1,000 Thousand tonnes of oil equivalent (Ktoe)
1 Billion cubic metres of natural gas (Bcm) = 1,000 Million cubic metres of natural gas (Mcm)
1 Bcm natural gas ≈ 1.226975019570429 Mtoe (For 2019 EU average)

[50] BP. 'Approximate Conversion Factors'. *Statistical Review of World Energy*, no. July (2021): p. 2. Accessed October 6, 2022. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-approximate-conversion-factors.pdf.

guideline instead of actual data. This chapter will also cover the reasoning behind for the selection of gross inland consumption in detail later.

In the year 2019 the European Union (excluding the United Kingdom) had a gross inland (energy) consumption that reached the equivalent of 1786.9 Bcm natural gas. Do bear in mind that the actual natural gas that was consumed stood around 411.1 bcm as the other energy sources such as oil, nuclear and renewables etc. constituted the remainder of this usage. Nevertheless, natural gas, still, captured the 23% of this equation (Eurostat 2022). In the figure 3.1., the rest of the constituents and their values in thousand tonnes of oil equivalent (KTOE) alongside of their percentages to total can be seen.

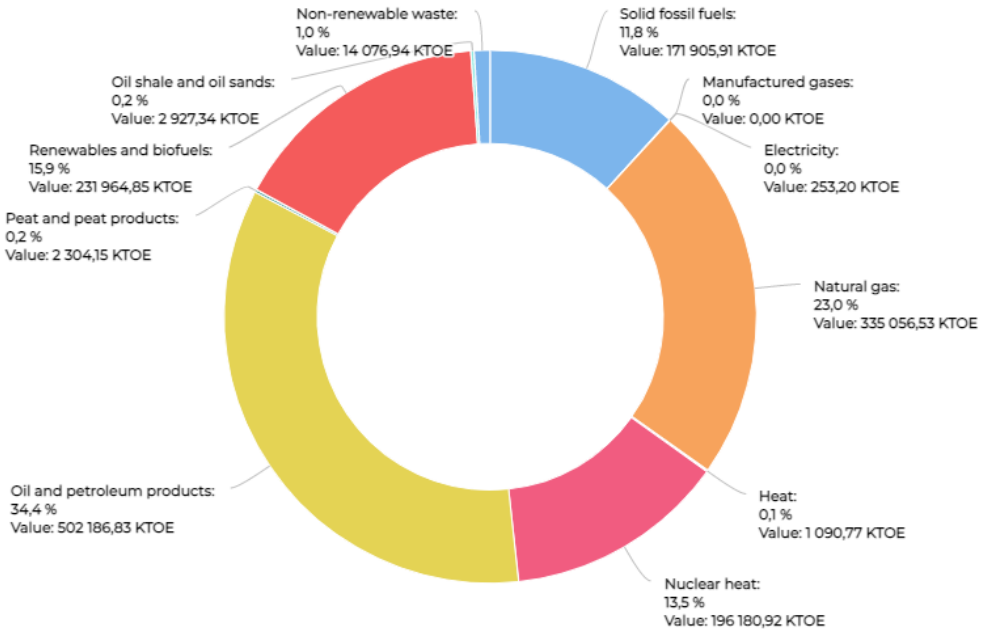


Figure 3.1: Gross Inland Consumption EU (27 countries) 2019

Source: Eurostat (2022)

Eurostat, defines the gross inland consumption as the total energy demand of a country or a region.[51] This term is a better tool to reach a general perspective as gross

[51] Eurostat. 'Glossary:Gross Inland Energy Consumption', n.d. Accessed October 9, 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Gross_inland_energy_consumption.

inland (energy) consumption includes the consumption of energy sector, transformation and distribution losses alongside with the final energy consumption of the end users such as homes or industries. To clarify, there is a difference in gross inland consumption and final energy consumption. For the final energy consumption, the energy sector and their resource consumption for electricity is excluded and that terminology mainly includes households, industries, agriculture, services, air, road and rail transportations etc. to its category.

The field of energy uses similar sounding terminologies that can be mistaken for each other. These terminologies are the gross energy consumption and the gross inland consumption. Gross energy consumption mainly deals with energy production itself and it includes heat and electricity which are the outputs of the energy transformation process. What it does not indicate, is that the usage of fuels that are consumed for other purposes rather than energy production.To give an example for the clarification, let us assume 1 bcm of natural gas and 1 tonne of coal give equal amount of power and a country uses 10 tonnes of coal and 5 bcm of natural gas to create electricity in its power plants. This electricity, in turn, is used by a fertilizer factory to transform another 5 bcm of natural gas into a fertilizer product.

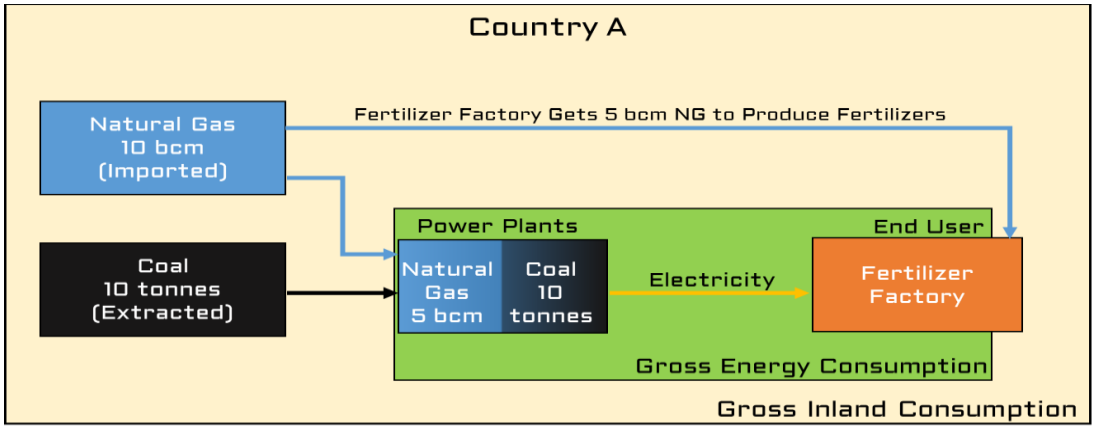


Figure 3.2: Example for Calculation Difference Between Gross Energy Consumption and Gross Inland Consumption

Source: Author

What the gross energy consumption will record is going to be the amount of natural gas and coal was spent in creation and consumption of energy in the country,

therefore, it will give 2-to-1 ratio for coal to natural gas consumption (10 tonnes of coal and 5 bcm of natural gas).

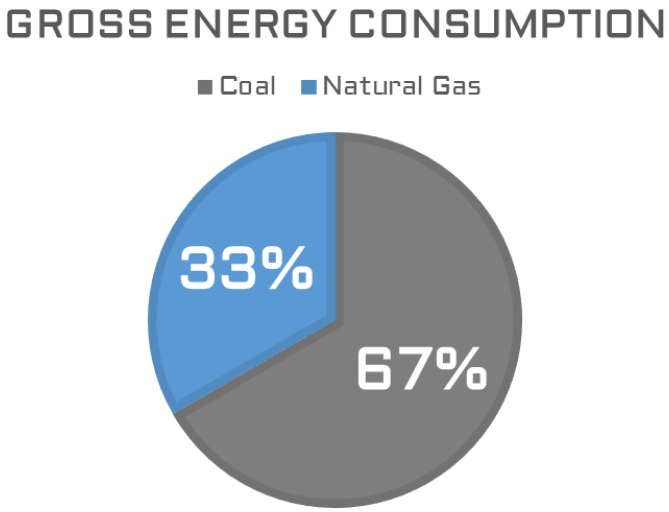


Figure 3.3: Gross Energy Consumption Result for Example Country

Source: Author

Gross energy consumption, however, will not give us a clear picture for the country A's total consumption of natural gas in this example. Thus, it may lead confusion as one can apply this example for other non-energy usage of resources in creating materials such as plastics. Although the creation of plastics require natural gas and oil as an essential components -and to heat up said materials may also require natural gas- gross energy consumption will not look at the input for creating plastics and just focuses on the end user consumption.

Returning back to our example, gross inland consumption will include the total amount of coal and natural gas regardless of whether they were used for creating energy or other purposes such as creating products or pipeline usage etc., thus, using it paves the way for more accurate data when it comes to the total resource consumption. The result for our example in gross inland consumption is shown on the figure 3.4. Thus, this research will fundamentally use gross inland consumption to better represent the total need of the resource.

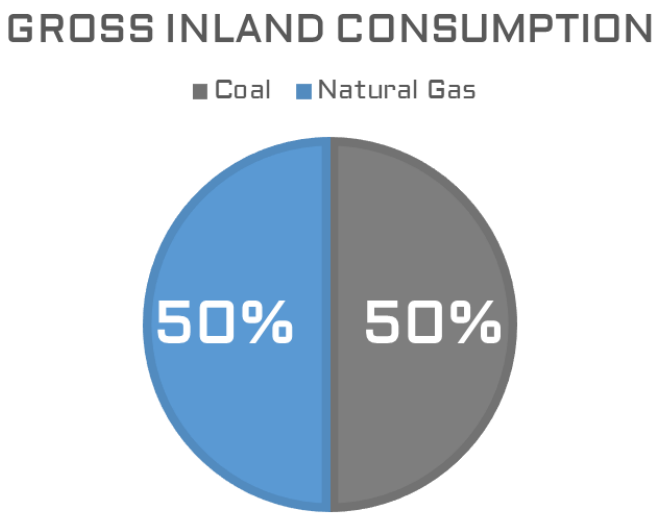


Figure 3.4: Gross Inland Consumption Result for Example Country

Source: Author

3.1. Natural Gas in the European Union

In the year 2019, the Eurostat database (see Table 3.1) shows that the total EU 27 countries' combined output for natural gas was around 69.8 bcm.; while the Union itself imported 440.29 bcm. for that year.[52] The total amount of 510 bcm. should not confuse the readers as around 78.1 bcm. from this total occurred in the intra-EU domain, meaning trade between the member states. Consequently, the remainder 20.9 bcm of natural gas was then sent to storage for later use after the gross inland consumption (Eurostat 2022). This situation brings about the conundrum of natural gas for the European Union as the total amount extracted could only sustain the 16.98% of total natural gas consumption.

It is, therefore, not surprising to see that there is a growing dependence on natural gas in the European Union with imports gaining ever more prevalance.[53]

[52] This value includes imports among EU member states.

[53] Percebois, Jacques. 2008. "The Supply of Natural Gas in the European Unionstrategic Issues." *OPEC Energy Review* 32 (1): 34. Accessed October 6, 2022. https://doi.org/10.1111/j.1753-0237.2008.00142.x.

Wood, David A. 2012. "A Review And Outlook For The Global LNG Trade". Journal Of Natural Gas Science And Engineering 9: 19. Accessed November 3, 2022. https://doi.org/10.1016/j.jngse.2012.05.002.

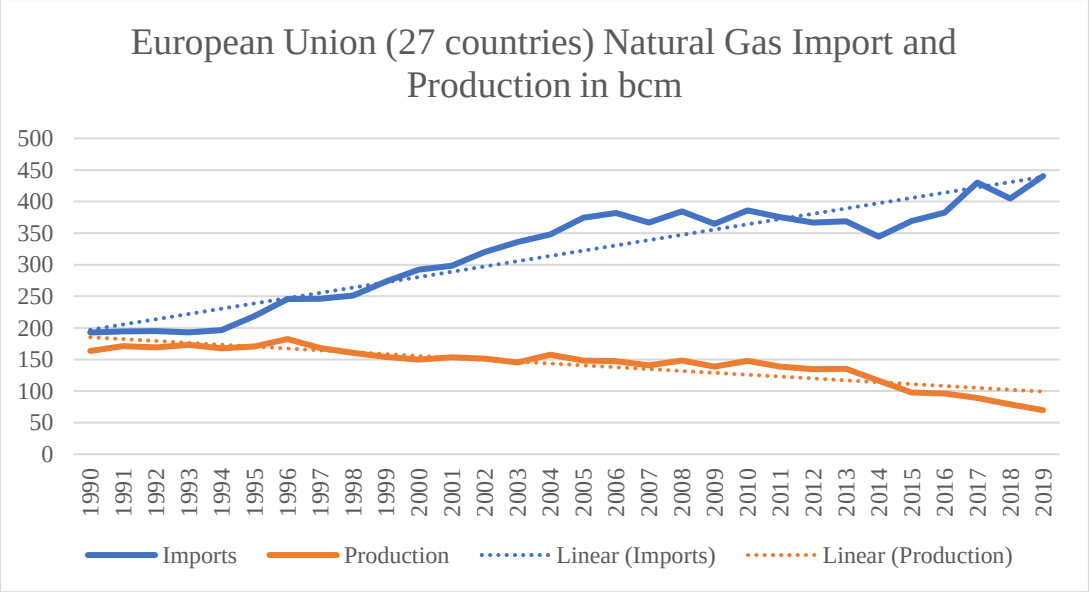


Figure 3.5: European Union (27 countries) Natural Gas Import and Production in bcm.

Source: Author with data obtained from Eurostat

3.1.1. Natural Gas Dependency of the European Union

To get a better understanding for the aforementioned growing dependence in the EU in terms of natural gas, Eurostat database provides substantial information. According to the database, energy imports dependency for the natural gas differs from country to country. This sub-chapter will categorize each member country of the European Union by taking a look at their general capabilities and the total amount of imports to determine the level of dependency of the said country in relation to natural gas.[54]

To calculate dependency rate the following equation is used in the study:

[54] The necessary items in the database can be reached from: Eurostat. 'Supply, Transformation and Consumption of Gas'. Eurostat, n.d. Accessed November 3, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_2322411/default/table?lang=en.

$$\frac{Net\ imports}{Gross\ available\ energy} = Dependency\ rate\ (\%)$$

This calculation is based on the Eurostat definition of energy dependency rate:[55]

$$\frac{Total\ import\ amount - Total\ export\ amount}{Gross\ available\ energy} = Dependency\ rate\ (\%)$$

If we expand the terminology for the gross available energy, the required calculation as follows:[56]

$$\frac{Total\ import\ amount - Total\ export\ amount}{Primary\ production + Recovered\ \&\ Recycled\ products + Imports - Exports + Stock\ changes} = Dependency\ rate\ (\%)$$

From the Complete Energy Balances data of Eurostat, -which, although, uses oil equivalent energy supply to define the total- the section of "Recovered and recycled products" for natural gas was found zero;[57] therefore, simplifying our equation to its final version as shared below:

$$\frac{Total\ import\ amount - Total\ export\ amount}{Primary\ production + Imports - Exports + Stock\ changes} = Dependency\ rate\ (\%)$$

[55] Eurostat. "Glossary: Energy Dependency Rate - Statistics Explained". 2022. *Ec.Europa.Eu*. Accessed October 3, 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Energy_dependency_rate.;

Eurostat. "Energy Imports Dependency (Nrg_Ind_Id) Reference Metadata". 2022. Ec.Europa.Eu. Accessed November 3, 2022. Available from: https://ec.europa.eu/eurostat/cache/metadata/en/nrg_ind_id_esms.htm. section 3.1. Data description

[56] Eurostat. *Energy Data — 2020 Edition*. 2020th ed. Luxembourg: Publications Office of the European Union, 2020. Accessed November 3, 2022. https://ec.europa.eu/eurostat/documents/3217494/11099022/KS-HB-20-001-EN-N.pdf/bf891880-1e3e-b4ba-0061-19810ebf2c64?t=1594715608000.

[57] Eurostat. 'Complete Energy Balances Data'. Eurostat, n.d. Accessed November 3, 2022. Available by clicking on the Expand Flow (+) icon next to the Total energy supply section from: https://ec.europa.eu/eurostat/cache/infographs/energy_balances/enbal.html.

Thus, with the use of aforementioned equation and information obtained from the Eurostat data is compiled in Table 3.1. This table shows the natural gas dependency rate of the member states and the EU total. As can be seen from the table, Denmark is the only country to have no dependency on the resource as it can produce more than it consumes. Somewhat similarly, Cyprus is another case where the country is not associated with natural gas since it neither produces nor consumes the resource.

Table 3.1: Natural Gas Data of EU Member States (in million cubic metres)

Country	Gross Inland Consumption	Imports	Production	Exports	Stock Change	Dependency Rate
Federal Republic of Germany	95,636	94,787	5,996	-	5,280	99.3%
Republic of Italy	74,470	71,065	4,800	325	1,121	95.1%
Kingdom of the Netherlands	44,618	59,288	33,410	47,663	236	25.9%
French Republic	41,938	54,948	16	10,789	1,884	104.4%
Kingdom of Spain	35,412	37,209	134	1,124	665	101.5%
Republic of Poland	20,739	17,451	5,652	1,328	686	76.5%
Kingdom of Belgium	18,497	23,227	4	4,400	324	101.7%
Romania	10,997	2,681	9,959	13	1,411	23.8%
Hungary	10,389	18,647	1,716	6,978	3,141	113.9%
Republic of Austria	9,277	14,191	929	2,814	3,045	122.8%
Czechia	8,684	9,533	209	-	1,058	109.8%
Portuguese Republic	6,061	6,069	-	-	-4	99.9%
Republic of Ireland	5,541	2,852	2,647	-	0	51.9%
Hellenic Republic	5,231	5,222	9	16	-49	98.9%
Slovak Republic	4,909	6,707	124	-	1,922	136.6%
Kingdom of Denmark	3,110	1,139	3,146	1,344	104	-7.2%
Republic of Croatia	2,908	2,003	1,029	72	52	66.4%
Republic of Bulgaria	2,857	2,950	39	8	51	100.4%
Republic of Finland	2,590	2,594	-	-	15	100.6%
Republic of Lithuania	2,232	2,749	-	518	-1	100.0%
Republic of Latvia	1,354	1,354	-	-	0	100.0%
Kingdom of Sweden	1,143	1,089	-	23	0	100.0%
Republic of Slovenia	904	899	7	2	0	99.2%
Grand Duchy of Luxembourg	783	779	-	-	0	100.0%
Republic of Estonia	461	486	-	-	0	100.0%
Republic of Malta	366	379	-	-	13	103.6%
Republic of Cyprus	N/A	N/A	N/A	N/A	N/A	N/A
European Union	**411,106**	**440,299**	**69,825**	**77,417**	**20,954**	**88.1%**

Source: Eurostat

According to Eurostat, dependency rates going above the 100% mean that the energy in question is being stocked up for that year.[58] Although, the combined EU rate

[58] Eurostat. "Glossary: Energy Dependency Rate - Statistics Explained". 2022.

stood around 80% for the dependency, we see that the members of European Union in general, had a tendency of getting more natural gas and spent the year 2019 by building up some of their stocks as they did in the previous two years.[59] The total of the stocked natural gas volume amounted to 96 bcm in the end of 2019.[60]

3.1.2. Natural Gas Imports of the European Union

It appears that the European Union has to sustain its economy by importing more and more natural gas from the outside as the domestic production does not only fall short on the required amount, but also on its own, is not sustainable when it is compared to consumption. It is therefore, also imperative for us to take a look at the main suppliers of the EU. According to the Eurostat webpage, in the year 2019, countries that supplied the majority of the European Union's natural gas imports were Russia, Norway, Algeria and Qatar.[61]

Ec.Europa.Eu. Accessed October 3, 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Energy_dependency_rate.

[59] Eurostat. 'Supply, Transformation and Consumption of Gas'. Eurostat, n.d. https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_2322411/default/table?lang=en.

[60] Eurostat. 'Stock Levels for Gaseous and Liquefied Natural Gas'. Eurostat, n.d. Accessed November 3, 2022. https://ec.europa.eu/eurostat/databrowser/view/NRG_STK_GAS__custom_3494301/default/table?lang=en.

[61] Eurostat. 'From Where Do We Import Energy?' European Commission. Accessed March 17, 2022. https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html#carouselControls?lang=en.

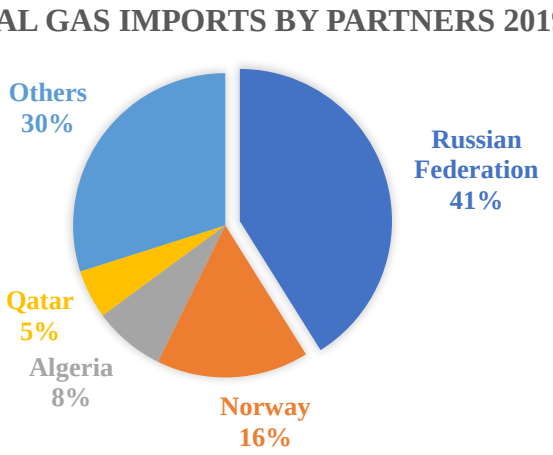


Figure 3.6: EU Natural Gas Imports by Partners in 2019

Source: Eurostat (n.d.)

Further examination of the Eurostat database[62] revealed that from the total 440.29 bcm that was imported in the year 2019, 406.31 bcm of natural gas was imported from the outside of the EU domain. Thus, the remainder (33.98 bcm.) came from member states trading with each other. Another important issue that was found in the database was the origin of 67.75 bcm natural gas was "not specified", meaning that no information about the origin was available or hidden due to confidentiality.[63] After the rearrangement of data for this thesis (which includes the imports from the United States -instead of being excluded in the Figure 3.5- and total exclusion of intra EU trade[64]), the Figure 3.6 was created to show a more detailed ratios for the EU imports in 2019.

[62] Eurostat. 'Imports of Natural Gas by Partner Country'. Eurostat, n.d. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_2416827/default/table?lang=en.

[63] Eurostat. 'Trade by Partner Country (Nrg_t) Reference Metadata'. Eurostat, n.d. Section 3.2. Classification system Available from: https://ec.europa.eu/eurostat/cache/metadata/en/nrg_t_esms.htm.

[64] EU 27 countries (Exclusion of United Kingdom, her exports included in Not Specified and Others)

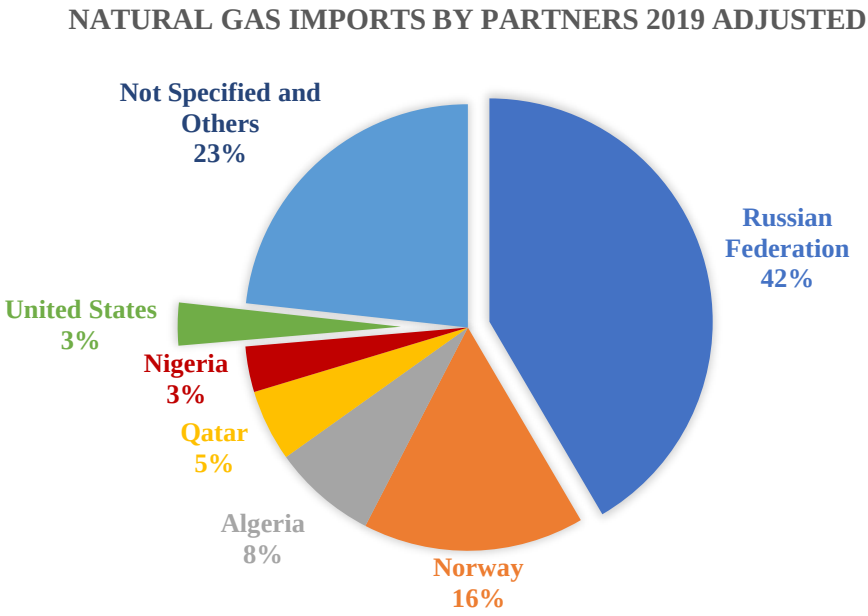


Figure 3.7: EU Natural Gas Imports by Partners in 2019 Adjusted

Source: Eurostat

As seen from the figure, there is a big discrepancy between Russian Federation and the rest of the natural gas exporting countries to the EU. Russia alone fulfills 42% of the total imports of the EU with 168.8 bcm. While the Eurostat figures are valid, the issue of limited information for intra-EU natural gas trade hinders the accuracy of this graph. Not clearly defined values like in the Austrian case may suggest that Russia may have even more predominant role than its shown.[65] Figure 3.8, attempts to clarify this issue as the estimated dependency for EU member states on Russian or any other source is better in terms of visibility when compared to the Eurostat data. Nevertheless, Russian gas exports remains as a contentious issue that divides the European Union.

[65] Austria uses "Not specified" for origin of all its imports since 2014.

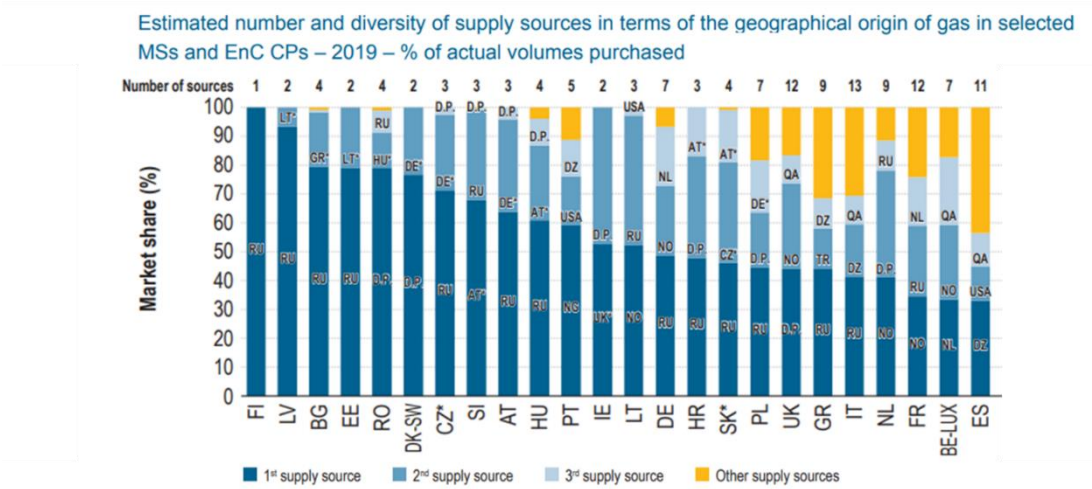


Figure 3.8: EU (Ex. Malta and Cyprus) Natural Gas Origin of Imports and Number of Supply Sources 2019[66]

Source: European Union Agency for the Cooperation of Energy Regulators (ACER)

Yergin, argues that while the Central and Eastern European countries, which are highly dependent on Russia for their gas imports, see their dependency as a sensitive issue that resembles their servitude years to Moscow back in the Cold War, the Western European countries predominantly hailed these imports as a positive.[67] This situation resulted with differing ideas on how to proceed with a common energy policy. Nonetheless, several attempts were made to address these problems and in creating an energy security such as the 2009 Gas Directive of the EU. This directive, -which, among the others will be discussed later- required the end of the pipeline ownership by the gas producers in the internal market, paving a way for ending monopoly of gas producers from owning the network.[68]

[66] Agency for the Cooperation of Energy Regulators (ACER). "Annual Report On The Results Of Monitoring The Internal Electricity And Natural Gas Markets In 2019". *Gas Wholesale Market Volume*, (September 2020): 32 Available from https://acer.europa.eu/Official_documents/Acts_of_the_Agency/Publication/ACER_Market_Monitoring_Report_2019-Gas_Wholesale_Markets_Volume.pdf.

[67] Yergin. "The New Map: energy, climate, and the clash of nations." p. 85.

[68] Russel, Martin. 'The Nord Stream 2 Pipeline Economic, Environmental and Geopolitical Issues', 2021. p. 4. Accessed October 6, 2022. https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/690705/EPRS_BRI(2021)690705_EN.pdf.

3.1.3. Natural Gas Infrastructure of the European Union

The European Union has a significant network of natural gas pipelines that connect many of its member states. These pipelines used to be single-directional that only brought gas from the country that was exporting it; meaning no real way to reverse or distribute gas between the member states should a need arise.

Figure 3.9: Major Natural Gas Pipelines (>900 mm) that Reach EU Member States

Source: European Network of Transmission System Operators for Gas Transparency (ENTSOG)

The issue of one-way pipelines gained more traction among member states as focus on reverse flow -ie. transporting the gas bi-directionally- was seen as an important issue.[69] Thus, several EU regulations were put in effect to enable reverse flow of natural gas (*Concerning measures to safeguard security of gas supply* Regulation 994/2010; Regulation 2017/1938).

Bi-directional capacity enables countries to effectively share the natural gas among themselves with less hassle and empowers the supply security, making these

[69] Rodríguez-Gómez, Nuria, Nicola Zaccarelli, and Ricardo Bolado-Lavín. *Improvement in the EU Gas Transmission Network between 2009 and 2014*. Publications Office, 2016. p. 15-16 Accessed October 6, 2022. https://doi.org/10.2790/708926.

countries to act as a hub for further distribution. In the year 2019, Gas Infrastructure Europe (GIE) and ENTSOG published a map that detailed the cross-border capabilities of European countries.

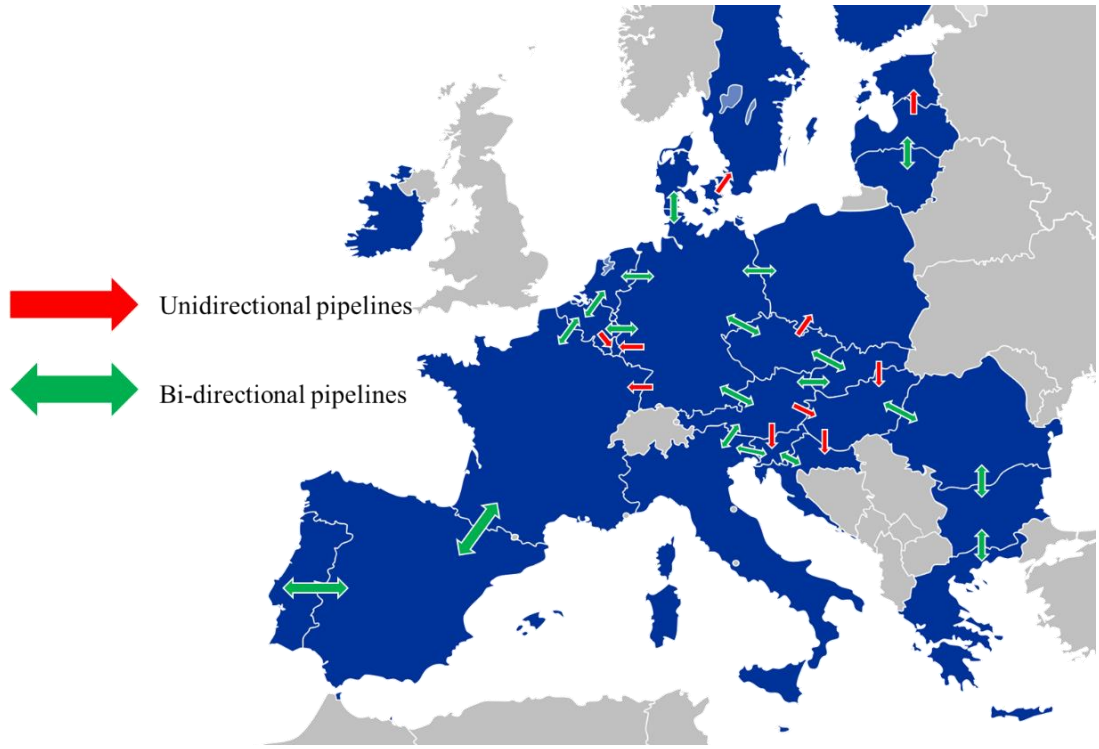


Figure 3.10: Bi-directional Capacity of Pipelines Spanning Across the Member States of the European Union
Source: Author with the data obtained from ENTSOG and GIE[70]

As seen from the Figure 3.10 dating 2019, while many member states have the ability to share the natural gas in both directions, some states like Estonia, Luxembourg and Sweden still have no means to redirect the flow, meaning they are still not fully integrated in European Gas market. Further examination of states like the Baltic countries not being fully connected to the gas grid (no transfer capacity between Poland and Lithuania) may indicate security of supply issues.

While it is important to see that some member states have limited connection to the broader EU grid (see figure 3.12), the use of LNG terminals can enhance the

[70] Further capacity in GWh/d and a map also detailing non-EU state capacities can be reached at: https://www.entsog.eu/sites/default/files/2020-01/ENTSOG_GIE_SYSDEV_2018-2019_1600x1200_FULL_063_clean.pdf

options for diversifying the supply. These terminals act as a safety net since they enable countries by reaching the global LNG sellers.

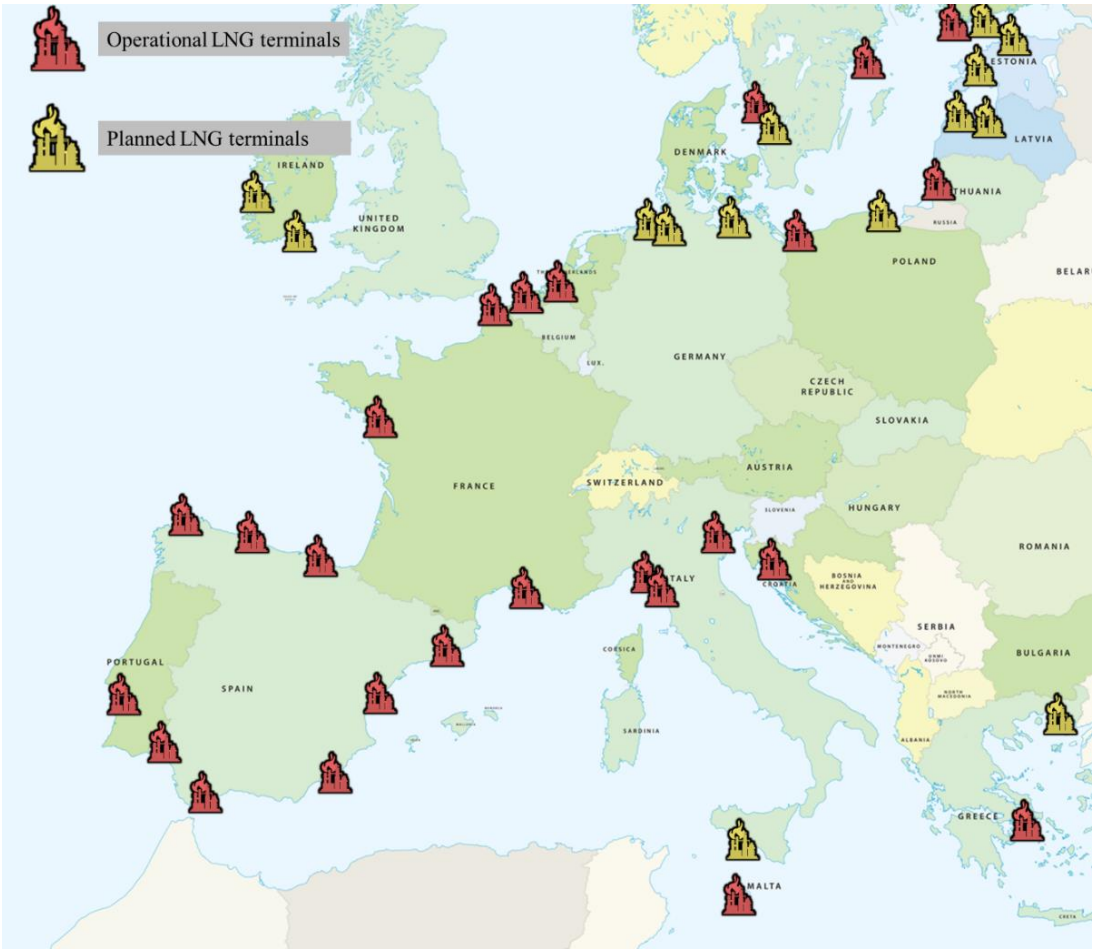
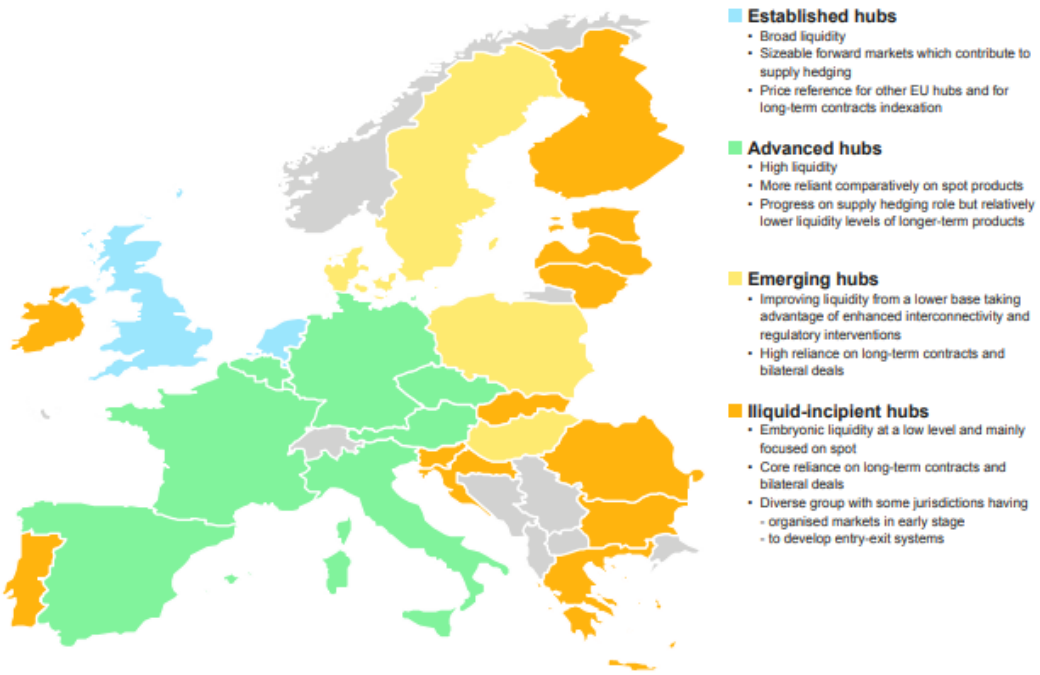


Figure 3.11: Operational and Planned LNG Terminals Across the Member States of the European Union (excluding the UK) in 2019
Source: Author with the data obtained from ENTSOG transparency and GIE[71]

[71] Further info also detailing non-EU state plans for 2019 can be reached at: https://www.gie.eu/wp-content/uploads/filr/4002/GIE_LNG_2019_A0_1189x841_FULL_100.pdf



Source: ACER based on AGTM metric results.

Figure 3.12: Ranking of Gas Hubs According to Monitoring Results in 2020
Source: ACER Market Monitoring Report 2020

The utilisation of the LNG regasification infrastructure is another issue to take into consideration.. The large-scale LNG terminals (excluding the UK) had an approximate total of 165 bcm per annum (including the mothballed El Musel in Spain) regasification capacity in 2019. This puts the LNG utilisation rate of EU-27 countries at 53% for that year. Table 3.2 shows the 2019 utilisation rates of the LNG terminals in the member states and the EU total in a more detailed manner.

Table 3.2: Large Scale Regasification Capacities and the Amount of Imported LNG (in million cubic metres) Coupled with Utilisation Rate in 2019 for EU-27 Countries

Countries	Imported	Capacity	Utilisation (%)
Spain	21,424	69,000	**31%**
France	20,316	34,000	**60%**
Italy	13,798	15,000	**92%**
Netherlands	10,426	12,000	**87%**
Belgium	6,732	9,000	**75%**
Portugal	5,582	8,000	**70%**
Poland	3,480	5,000	**70%**
Greece	2,802	7,000	**40%**
Lithuania	1,558	4,000	**39%**
Malta	379	1,000	**38%**
Sweden	300	600	**50%**
Finland	181	500	**36%**
EU Total	86,980	165,100	**53%**

Source: Author with the data obtained from Eurostat and GIE

This information can be used to further our understanding in the total coverage capacity of the LNG terminals in regards to the gross inland consumption of the European Union. As it was indicated in the GIE report back in 2019, EU 27 countries had the conversion capacity of 165 bcm of LNG, with additional 9 bcm of infrastrucure projects that were in the phase of being constructed.[72] If we refer back to the chapter 3.1.1., EU 27 countries required 411.1 bcm of natural gas for their gross inland consumption in 2019 (See Table 3.1). 69.8 bcm of indigenous production in the year 2019 "in theory" could bring the necessary imports to the 341.3 billion cubic metre level for the same year. Thus, the already installed infrastructure of the LNG terminals in the union can sufficiently cover 48% of the potential total imports.

If one includes the large import capacity terminals that were under the planning phase in 2019 from the Gas Infrastructure Europe, this new potential capacity can

[72] Gas Infrastructure Europe. 'LNG MAP Existing & Planned Infrastructure 2019', 2019. Accessed October 19, 2022. Available from: https://www.gie.eu/download/maps/2019/GIE_LNG_2019_A0_1189x841_FULL_Final3.pdf.

reach above 75% in terms of coverage of the total imports.[73] However, as the indigenous production gradually decreases due to time (see figure 3.5), so can the natural gas consumption may vary from one year to another. With the possibility that these plans may be scrapped at any point, rendering the potential projections for the future void; the LNG capacity, at the current rate, remains as capable only to cover half of the gross inland consumption of the EU.

3.1.4. Other Significant Natural Gas Pipelines in the Context of Diversity of Supply

As indicated in the previous sub-chapter, the European Union does not have the capacity to fulfil its entire demand in natural gas via LNG terminals by themselves. This issue, however, does not necessarily mean the Union is out of options. If the European Union seeks to distance itself from the Russian natural gas, there are options to do so. This chapter focuses on the pipelines that can enable the EU to reduce its dependency on Russia. It will take a look at the infrastructure capacities that are not originating from Russia to determine whether they are sufficient enough to cover the remainder potential demand that can not be fulfilled by LNG terminals alone.

[73] GIE report for 2019 indicate that the LNG plans and established infrastructure reaches 268 bcm per year when the UK is excluded. Therefore, this new potential capacity can fulfill 78.52% of the 341.3 bcm that is required.

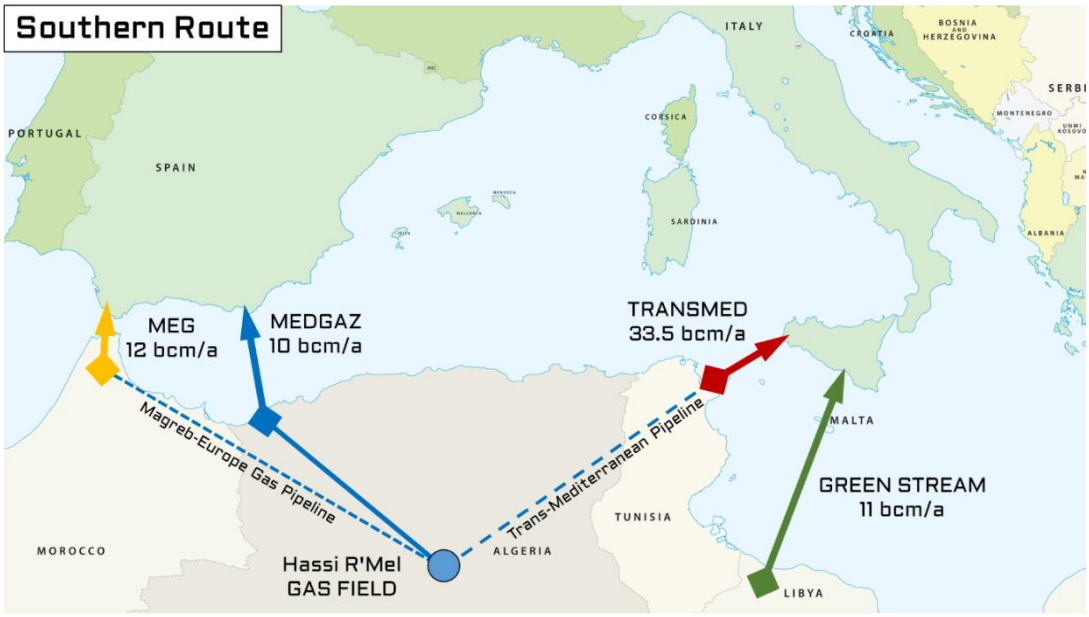


Figure 3.13: Simplified Pipeline Connections to the EU from Africa
Source: Author with data acquired from ENTSOG

The Southern Route mainly deals with the natural gas coming from the Algerian Hassi R'Mel Gas Field. Two of the three major pipelines starting from this region transit through other neighbouring countries before passing the Mediterranean Sea. Magreb-Europe Gas Pipeline goes west and transits through Morocco before reaching Spanish shores. Trans-Mediterranean Pipeline follows the opposite direction and transits through Tunisia before reaching Italy. The last connection, which is MEDGAZ, is the only domestic route for Algeria to supply Europe with natural gas without any cross-border interaction.

The Green Stream, on the other hand, starts from Libya and connects to Italy without any transit countries in between, hence, shares the same characteristics of MEDGAZ but, it is not connected to Hassi R'mel field unlike others.

If one wants to go into the details for this region, Magreb-Europe Gas Pipeline became operational in 1996[74] and has increased its capacity in between the years of

[74] The official site of the pipeline was found down at the revision on October 4th, yet it is still accessible by web archive engine. empl. 2019. "History". http://www.emplpipeline.com. Accessed October 4.
https://web.archive.org/web/20191226134536/http://www.emplpipeline.com/en/history/. Original site available from: http://www.emplpipeline.com/en/history/

2002-2005 to potentially reach supplying 12.5 bcm of natural gas per year.[75] This pipeline has been subject to a closure in the final quarter of 2021 due to disagreements between Algeria and Morocco when the former decided not to renew the contract.[76]

As for the Medgaz, the pipeline started exporting directly from Algeria to Spain in the first quarter of 2011.[77] The project back then had a capacity to transfer 8 billion cubic metres per year; and in 2019, the company issued a press release to further increase the capacity to 10 bcm.[78] This improvement became operational in 2021.[79]

Further along the east we reach the last branch that is originating from Algerian Hassi R'Mel Gas Field, the TransMed. The Trans-Mediterranean Pipeline is the oldest branch of the pipelines existing in the region with its commission dating back to the 1983. It goes through Tunisia first to reach Italian shores and go further inland from there. Its capacity originally started from 30.2 bcm a year to eventually reach 33.5 bcm.[80]

The final pipeline the Green Stream was commissioned in 2004. It is similar to Medgaz as it too was used to export the domestic production directly without any transit countries in between. It has the capacity of exporting 11 bcm of natural gas in

[75] The official site of the pipeline was found down at the revision on October 4th, yet it is still accessible by web archive engine. empl. 2020. "Expansion". *http://www.emplpipeline.com*. Accessed October 4. https://web.archive.org/web/20200223190733/http://www.emplpipeline.com/en/expansion/. Original site available from: http://www.emplpipeline.com/en/expansion/

[76] Atalayar. 2021. "Algeria Blames Morocco For Maghreb Gas Pipeline Closure", 2021. Available from: https://atalayar.com/en/content/algeria-blames-morocco-maghreb-gas-pipeline-closure.

[77] Medgaz. "Timetable" Accessed October 4, 2022. Available from: https://www.medgaz.com/medgaz/pages/fases_calendario-eng.htm

[78]Medgaz. 2019. "Press Release." Accessed October 4, 2022. Available from: https://www.medgaz.com/medgaz/pages/nota_prensa_35-eng.htm.

[79]Benali, Arezki. 2021. "Gaz : Les Capacités d'exportation Du Medgaz Augmenteront à 10,5 Milliards de M3 Fin Novembre." Algerie Eco, 2021. https://www.algerie-eco.com/2021/09/01/gaz-capacites-exportation-medgaz-augmenteront-105-milliards-m3-fin-novembre/.

[80] "Trans-Mediterranean Natural Gas Pipeline." n.d. Hydrocarbons Technology. Available from: https://www.hydrocarbons-technology.com/projects/trans-med-pipeline/.

a year.[81] Unfortunately during and after the Arab Spring, the pipeline had interruptions, leading to the line not being used with its full potential.[82]

Figure 3.14: Simplified Pipeline Connections to the EU from Caucasia (with Potential Increase in Capacity)
Source: Author with data acquired from ENTSOG

The Eastern Route also known as "Southern Gas Corridor" aims at bringing Caucasian gas to the southern part of the European Union with Azerbaijan as the origin country extracting gas. This route is a bit more complex when it is compared to the Southern Route. If we dwell on the reasons why firstly, it is due to the fact that, there are more transit countries from the point of origin before the gas itself reaches the European Union member states. Secondly, among the transit countries, one, which is Turkey, is also a candidate member of the European Union with a significant potential in consuming this resource. In the light of this information, this thesis' coverage of the Eastern Route will focus on the whole scale, with parts of the network explained section by section starting from the originating country.

[81] "Greenstream Pipeline." n.d. Global Energy Monitor Wiki. Accessed October 4, 2022. Available from: https://www.gem.wiki/Greenstream_Pipeline.

[82] ibid.

In 15th of December 2006, Azerbaijan, under the South Caucasus Pipeline (SCP) have started to deliver its natural gas from the Shah Deniz field to Turkey with the capacity reaching somewhere around 7.41[83] to 9[84] bcm a year. This route mainly emerged to help Turkey and Georgia with their demand for natural gas.[85] The route covers the beginning from the Sangachal Terminal and transits through the capital cities of both Azerbaijan and Georgia, Baku and Tbilisi respectively. After entering the Turkish border, the city Erzurum is the final destination for the project. Furthermore, according to the BP, this pipeline was constructed alongside with the Baku-Tbilisi-Ceyhan oil pipeline while also sharing the same underground transmission characteristic.[86]

Under the Project(s) of Common Interest code 7.1.1 of the EU Commission *"Gas pipeline to the EU from Turkmenistan and Azerbaijan, via Georgia and Turkey"* this network has been further upgraded.[87]

The first section, the already established South Caucasus Pipeline, was upgraded with South Caucasus Pipeline Expansion (shortened as SCPX) and began transmitting natural gas on 30th of June 2018.[88] This new line furthered the capacity of SCP with additional 16 bcm, totaling at somewhere around 23[89]-24[90] bcm annually. This new line also connects to the TANAP at the border between Georgia and Turkey.

---

[83] "South Caucasus Pipeline (SCP)." n.d. Southern Gas Corridor. Accessed October 4, 2022. Available from: https://www.sgc.az/en/project/scp.

[84]Oil Voice. 2006. "Azerbaijan's Shah Deniz Field On Stream," 2006. Accessed October 4, 2022. https://web.archive.org/web/20160306024611/http:/www.oilvoice.com/n/Azerbaijans_Shah_Deniz_Field_On_Stream/6f7f7be8.aspx.

[85] Economic impact section "South Caucasus Gas Pipeline." n.d. Global Energy Monitor Wiki. Accessed October 4, 2022. https://www.gem.wiki/South_Caucasus_Gas_Pipeline.

[86] "South Caucasus Pipeline Project." n.d. BP. Accessed October 4, 2022. Available from: https://www.bp.com/en_ge/georgia/home/who-we-are/scp.html.

[87] "Project of Common Interest: 7.1.1 Southern Gas Corridor." 2020. European Commission. Available from: https://ec.europa.eu/energy/maps/pci_fiches/PciFiche_7.1.1.pdf.

[88] "South Caucasus Pipeline Expansion (SCPX)." Southern Gas Corridor. Available from: https://www.sgc.az/en/project/scp

[89] "South Caucasus Pipeline Expansion Project (SCPX)." n.d. BP. Accessed October 4, 2022. Available from: https://www.bp.com/en_ge/georgia/home/who-we-are/scp.html#

[90] "South Caucasus Pipeline Expansion (SCPX)." Southern Gas Corridor.

Therefore, the SCP route now has two pipelines, one at the Georgian-Turkish border where TANAP takes over, and the other one -being the initial pipeline- reaching Erzurum.

With its 1.811 km length, the next and the longest leg of the branch for the Azeri gas is located in Turkey.[91] The construction of the TANAP, also known as the Trans-Anatolian Natural Gas Pipeline, began in March 2015; with the first gas for the domestic use was delivered in the second quarter of the 2018.[92] According to the official website and brochure of TANAP, the initial trasmission capability of the pipeline reaches to 16 bcm a year with potential to further improve this level to 31 bcm a year in the future.[93] On the final destination, the TANAP project brings the Azeri natural gas to the European Union member states by connecting to TAP in Greece.

The Trans-Adriatic Pipeline, shortened as TAP, is the last leg for the Azeri natural gas in its journey to European Union. Dating back all the way to the 2003, the project aimed at connecting Greece, Albania and Italy to TANAP project. The construction phase started in 2016 with the aim of 10 bcm. per year gas transportation capability along with the possibility to increase it to 20 bcm in later stages.[94] On 15th of November 2020, the commercial operations were greenlit and the project became operational thus, making the EU's Project of Common Interest of *Southern Gas Corridor* active. According to official TAP website news dating 07 July 2021, there is now a possibility of making the pipeline bi-directional.[95] Previously, the only option -or a bottleneck- for the transmission of natural gas that is coming from the Balkans was to utilize Hungarian-Croat line, which, from then on can be used in a wider grid in the EU proper. If we refer back to the Figure 3.10, this project now has enabled a

[91] "Route and Above Ground Installations." n.d. TANAP. Accessed October 5, 2022. Available from: https://www.tanap.com/en/route-above-ground-installations.

[92] "Project Background." n.d. TANAP. Accessed October 5, 2022. Available from: https://www.tanap.com/en/project-background

[93] "Route and Above Ground Installations." n.d. TANAP.

[94] "Pipeline Facts and Figures." n.d. Trans Adriatic Pipeline. Available from: https://www.tap-ag.com/infrastructure-operation/pipeline-facts-and-figures.

[95] "TAP to Deliver the First Gas Exit Point in Fier, Albania." n.d. Trans Adriatic Pipeline. Available from: https://www.tap-ag.com/news/news-stories/tap-to-deliver-the-first-gas-exit-point-in-fier-albania.

new connection between Greece and Italy, therefore, it is not wrong to assume that it has increased the energy safety of European Union by making new connections to propagate natural gas. To sum up, the TAP cleared a bottleneck existing in Balkans and established a wider new link with another significant gas supplying country other than the Russian Federation.[96]

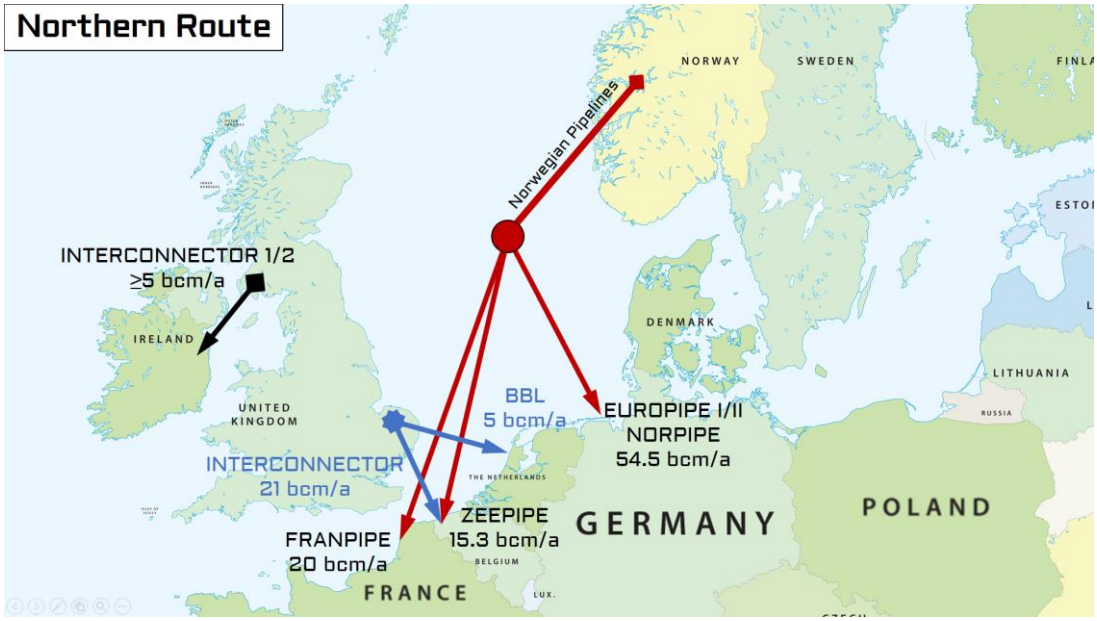


Figure 3.15: Simplified Pipeline Connections to the EU from Norway and United Kingdom
Source: Author with data acquired from ENTSOG

The Northern Route mainly deals with the Norwegian gas exports to the European Union. Referring back to the figure 3.6, Norway has always been an important natural gas partner for the Union. According to the Eurostat database, Norway retained its second biggest natural gas supplier status to the European Union for almost two decades (2001-2020), supplying 16% of the demand in 2019.[97] Flow of the Norwegian natural gas to the EU is achieved by 5 major pipelines that are located

[96] For further technical description on PCI 7.1.1 Available from: https://ec.europa.eu/energy/maps/pci_fiches/PciFiche_7.1.1.pdf

[97] Eurostat. 'Imports of natural gas by partner country (NRG_TI_GAS)' Accessed November 5, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_2311156/default/table?lang=en

in the Northern Sea. As far as the pipelines from the North is considered, the United Kingdom is also included in this section due to the country's already existing natural gas transmission capacity connecting to the European mainland and Ireland. These are achieved via pipelines with which the transmission of gas can occur bidirectionally.

As mentioned earlier, Norway connects its natural gas infrastructure with the European Union via five pipelines. These 5 pipelines -alongside with the majority of infrastructure for that matter- are operated by state owned company Gassco. The delivery of the Norwegian natural gas to the EU proper is achieved by Norpipe (1977), Zeepipe (1993), Europipe I (1995), Franpipe (1998), Europipe II (1999).

The Norwegian Gassco, which is a European Network of Transmission System Operators for Gas observer company (ENTSOG), designates the capacity of the pipelines they are operating in accordance to the Regulation (EC) No 715/2009, hence, the values were multiplied to find the annual rates.[98] The final results were then verified on the Eurostat data so as not to give wrong information. In the order of date of these pipelines becoming operational, their capacities are listed below:

Norpipe: 11.7 bcm/a capacity to deliver natural gas to Germany

Zeepipe: 15.3 bcm/a capacity to deliver natural gas to Netherlands

Europipe I: 16.8 bcm/a capacity to deliver natural gas to Germany

Franpipe: 20 bcm/a capacity to deliver natural gas to France

Europipe II: 26 bcm/a capacity to deliver natural gas to Germany

For the United Kingdom's case, the necessary technical information for the pipelines' capacity was found at the Office of Gas and Electricity Markets (OFGEM) website via their impact assesment.[99] This data was then screened by the both

[98] Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005 (Text with EEA relevance)

[99] Ofgem. 2019. "Impact Assessment." p.7. Accessed October 5, 2022. Available from: https://www.ofgem.gov.uk/sites/default/files/docs/2019/12/impact_assessment_0.pdf.

pipeline's offical websites (BBL and Fluxys)[100] and further cross-checked via ENTSOG map to ensure accuracy.[101]

The United Kingdom has two bi-direction capable pipelines with the European continent. These pipelines in the order of their commissioning are called the Interconnector (1998) and the Balgzand Bacton Line, also known as BBL, (2006) respectively. These pipelines although, have reverse-flow characteristics, the capacity to deliver varies when choosing a direction; yet, this bias is geared towards gas going to the UK direction in both of the cases. During the research, however, one discrepancy was found. The UK's natural gas exports to the Netherlands is found to be above the pipeline capacity connecting these two countries. Furhermore, Eurostat export data for the United Kingdom to the Netherlands in natural gas is different when it was compared with the Netherlands imports in the cross-checking.

In light of these revelations, the given technical capacity of the Interconnector which is situated between Belgium and the UK, is capable of reverse-flowing 21 bcm of natural gas to the EU in a year. The Balgzand Bacton Line (BBL) on the other hand, is only capable of delivering around mere 5 bcm a year to the Netherlands.[102]

The special case for the United Kingdom is its connection with the Ireland. Since Ireland does not have a connection to the wider world such as LNG terminals (see Figure 3.11), the country is currently dependent on the pipelines reaching the UK for its natural gas imports. As it was found in the section 3.1.1, Ireland required around 5.5 bcm of natural gas for its annual inland consumption in 2019. Further Eurostat examination of Ireland's gross inland consumption since the 1990's reveal that the country has been requiring more than 5 bcm annually to sustain its demand since

---

[100] "About BBL." n.d. BBL Company. Accessed October 5, 2022. Available from: https://www.bblcompany.com/about-bbl.

"Interconnector Infrastructure." n.d. Fluxys. Accessed October 5, 2022. Available from: https://www.fluxys.com/en/company/interconnector-uk/infrastructure.

[101] For finding the range of gross calorific value of the pipeline as well as the flow capacity: ENTSOG. 'Capacities At Cross-Border Points On The Primary Market'. *The European Natural Gas Network*, 2017. Accessed October 5, 2022. Available from: https://www.entsog.eu/sites/default/files/2018-09/ENTSOG_CAP_2017_A0_1189x841_FULL_064.pdf.

[102] "About BBL." n.d. BBL Company.; "Interconnector Infrastructure." n.d. Fluxys.

2016.[103] As seen in the figure 3.16, Ireland imported around 5.2 bcm from the United Kingdom in 2010.[104] Therefore, it should not be wrong to assume the pipelines connecting the UK to the Ireland has the capacity to fulfil the majority of Ireland's demand.

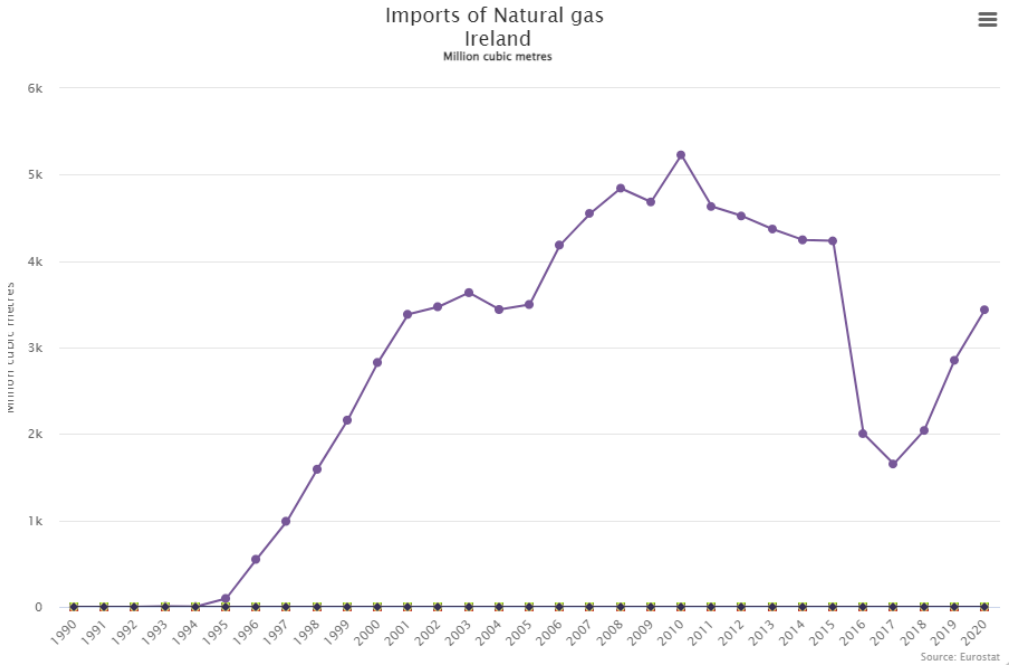


Figure 3.16: Imports of Natural Gas in Ireland (in million cubic metres)
Source: Eurostat

3.2. Developments Concerning Natural Gas and Energy in the European Union

With the general technical information for the capacity and connection points of the natural gas in the European Union cleared, this section will now focus on both the historical legal progress regarding natural gas in the EU, and the recent events that are related to the natural gas sector domain in general.

[103] For data covering the period between 1990-2020, further information is available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_2812313/default/line?lang=en

[104]Further information can be obtained via the following link. The initial graph is using GCV, but it can be changed to million cubic metres by "select unit" that is located in the left side: https://ec.europa.eu/eurostat/cache/infographs/energy_trade/entrade.html?geo=IE&year=2020&language=EN&trade=imp&siec=G3000&filter=all&fuel=gas&unit=MIO_M3&defaultUnit=TJ_GCV&detail=1&chart=time

3.2.1. Legal Acts of the European Union

History of the European Union with its actions regarding the energy domain spans several years with each supplementing iteration in rules and regulations bringing in new ideas and actions to better adapt the Union to the changing times. On the whole, Article 194 of the Treaty on the Functioning of the European Union (TFEU) has brought some of the aspects of the energy domain to the shared competence level.[105] This treaty, coupled with the legal foundation created in other articles, have made it possible for the EU to have a common approach in regards to coal and nuclear energy, security of supply, energy networks. Furthermore, they also acted as a catalyst for broadening the Union's internal energy market alongside the regulation of the external energy policies.

According to the Fact Sheets on the European Union, several achievements are related to natural gas and, therefore, must be further examined. These achievements cover a wide variety of issues hence they are organised in a historic manner. The initial steps the EU has taken on the issue of natural gas was about the liberalisation of the market due to the fact that it has been largely monopolised on national level; just like the electricity.[106] The commission has approved the proposal for a directive on the issue before the Maastricht Treaty was even signed. The culmination, (Directive 98/30/EC[107]), has laid the foundations for the creation of internal market for natural gas by establishing common rules.

Further on, the Directive 2003/55/EC has enabled the customers to partake in choosing their supplier freely.[108] This directive, replacing the Directive 98/30/EC, aimed for the creation of the necessary environment for competition in order to ensure

---

[105] "Energy Policy: General Principles." n.d. European Parliament. Accessed October 9, 2022. Available from: https://www.europarl.europa.eu/factsheets/en/sheet/68/energy-policy-general-principles.

[106] ibid.

[107] Directive 98/30/EC of the European Parliament and of the Council of 22 June 1998 concerning common rules for the internal market in natural gas OJ L 204, 21.7.1998, p. 1–12

[108] Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC OJ L 176, 15.7.2003, p. 57–78

quality as well as the security of supply by furthering the openness of the market by guaranteeing non-discrimination and giving the right for third parties to establish themselves as a supplier while making sure to curtail any dominance that can emerge. The Regulation (EC) No 1775/2005 furthered the previously mentioned directive with opening up of the information on the capacity allocation for system operators and setting up rules on tariffs to ensure that their alignment did not contest the open market conditions.[109]

During this transition towards an open market conditions, the European Union has recognized the importance of the security of supply for the natural gas as the Green Paper and the Council Directive 2004/67/EC explicitly mention that in the future, the path down the road will be that of more dependence on the countries that supply the Union with natural gas.[110] Hence, one can interpret the aforementioned Council Directive as the first step in the security dimension as it seeks to have the member states to have some degree of reserves for emergencies should one arises (Article 3 and 4).

Four years later, in 2008, the Regulation (EC) No 1099/2008, has created the common framework for the EU-wide information gathering on energy statistics.[111] It was indicated on the 8th point on the regulation that the security of supply for important fuels will receive more attention in the future. Therefore, it highlighted the need for more accurate and timely data that can predict possible emergencies and help harmonizing union-wide responses. From this regulation onwards the Eurostat started to receive monthly and annually reports from the countries, which in turn, enabled this research to obtain the necessary data from the member states.

---

[109] Regulation (EC) No 1775/2005 of the European Parliament and of the Council of 28 September 2005 on conditions for access to the natural gas transmission networks (Text with EEA relevance) OJ L 289, 3.11.2005, p. 1–13

[110] European Commission. 2000. *Green Paper - Towards a European Strategy for the Security of Energy Supply*. p. 43-46 Accessed October 9, 2022. Available from: https://op.europa.eu/en/publication-detail/-/publication/0ef8d03f-7c54-41b6-ab89-6b93e61fd37c/language-en#.;

Council Directive 2004/67/EC of 26 April 2004 concerning measures to safeguard security of natural gas supply (Text with EEA relevance) OJ L 127, 29.4.2004, p. 92–96

[111] Regulation (EC) No 1099/2008 of the European Parliament and of the Council of 22 October 2008 on energy statistics (Text with EEA relevance) OJ L 304, 14.11.2008, p. 1–62

On the same year Directive 2008/92/EC established more oversight for the EU by making the terms and price for the industrial end-users to be gathered by the Eurostat.[112] This directive -while indicating that the results would not be published- gave the Eurostat officials a tool to compare the suppliers which ensured a fair treatment for the consumers.

The necessity of finalizing the internal markets in electricity and natural gas was further underlined in the Commission's Communication titled "An Energy Policy for Europe" on January 10, 2007.[113] Improving the regulatory environment at the community level has been regarded as a vital step toward achieving that goal.

On 13 July 2009, the president of the European Parliament and the president of the Council signed a new directive. While the Directive 2003/55/EC[114] sought to achieve separation between the producers and the transmission operators, the new directive, Directive 2009/73/EC, recognised the shortcomings of the progress.[115] Thus, in it, we see that this new directive has stressed the importance of the "unbundling" of suppliers and producers of natural gas with the operators of the transmission infrastructure. In a nutshell, this meant that the producers and the distributers of natural gas should not be the same. The Directive 2009/73/EC, replaced the former one while updating the common rules for the natural gas internal market. On the same day, two important regulations were also signed by the aforementioned presidents. The first regulation, the Regulation (EC) No 713/2009, established the Agency for the Cooperation of Energy Regulators (ACER).[116] This agency, within the EU's broader

[112] Directive 2008/92/EC of the European Parliament and of the Council of 22 October 2008 concerning a Community procedure to improve the transparency of gas and electricity prices charged to industrial end-users (recast) (Text with EEA relevance) OJ L 298, 7.11.2008, p. 9–19

[113] Communication from the Commission to the European Council and the European Parliament - an energy policy for Europe {SEC(2007) 12} /* COM/2007/0001 final */

[114] Directive 2003/55/EC of the European Parliament and of the Council of 26 June 2003 concerning common rules for the internal market in natural gas and repealing Directive 98/30/EC OJ L 176, 15.7.2003, p. 57–78

[115] Directive 2009/73/EC of the European Parliament and of the Council of 13 July 2009 concerning common rules for the internal market in natural gas and repealing Directive 2003/55/EC (Text with EEA relevance) OJ L 211, 14.8.2009, p. 94–136

[116] Regulation (EC) No 713/2009 of the European Parliament and of the Council of 13 July 2009 establishing an Agency for the Cooperation of Energy Regulators (Text with EEA relevance) OJ L 211, 14.8.2009, p. 1–14

energy policy objectives, plays a key role in creating EU-wide infrastructure and market rules for gas and electricity. While early in its creation, ACER was responsible for giving recommendations and non-binding opinions for the various EU bodies alongside with transmission system operators and the regulatory authorities.[117] Furthermore it only had the competency to give binding decisions in specific cross-border infrastructure matters. As the years went on, it gained more prevalent role such as preventing market manipulation and insider trading in 2011 and identifying and monitoring common-interest projects in 2013. Culmination of the roles happened with the Regulation (EU) 2019/942 which granted the agency with competence on approving methodologies, terms and conditions that are relevant in every member state; infrastructure dealings, arbitration on cross-border issues as well as granting exemptions from some market rules.[118] Its enshrined the agency's status as an independent actor, free from the control of corporations and individuals makes it possible for the agency to act in the best interest of the European Union.

The second regulation, the Regulation (EC) No 715/2009, repealed the Regulation (EC) No 1775/2005 which was discussed earlier and was about the transmission system operators, tariff guidelines and the access conditions that did not hamper the open market character.[119] This new regulation, as it was especially discussed in the 3rd, 7th, 11th, 13th, and finally in the 16th point on the regulation, saw the necessary changes that were required to ensure effective realisation of the internal market for natural gas in the Union. The regulation sought to create an enforceable legal background for the equal access opportunity. Furthermore, it also updated how the tariffs are set for the usage and access of the gas networks. Perhaps more

---

[117] Langsdorf, Susanne. 2011. *EU Energy Policy: From the ECSC to the Energy Roadmap 2050*. Green European Foundation. p. 4. Accessed October 9, 2022. http://archive.gef.eu/uploads/media/History_of_EU_energy_policy.pdf. p.4

[118] Regulation (EU) 2019/942 of the European Parliament and of the Council of 5 June 2019 establishing a European Union Agency for the Cooperation of Energy Regulators (Text with EEA relevance.) OJ L 158, 14.6.2019, p. 22–53;

FSR. 2020. "The Clean Energy for All Europeans Package." Florence School of Regulation. 2020. https://fsr.eui.eu/the-clean-energy-for-all-europeans-package/.

[119] Regulation (EC) No 715/2009 of the European Parliament and of the Council of 13 July 2009 on conditions for access to the natural gas transmission networks and repealing Regulation (EC) No 1775/2005 (Text with EEA relevance) OJ L 211, 14.8.2009, p. 36–54

importantly, this regulation is the founding document for the European Network of Transmission System Operators for Gas (ENTSOG), which is overseen by the ACER and is responsible for the adoption of network operation tools in a common framework alongside with development plans and reports on a yearly basis as well as summer and winter supply projections.[120] ENTSOG's works on network tools are also used extensively by this thesis to accurately determine the capacity of the LNG terminals and the pipelines that are currently in use. Therefore, this regulation shows significant validity in terms of creating transparency.

The year 2010 resulted with the changes in the security dimension as it was acknowledged in the first and the second point of the Regulation (EU) No 994/2010. In the regulation, we see that the need for natural gas was growing and the resource itself was deemed crucial for it generated ¼th of the energy that the Union required for the purposes of heating, raw material for industry as well as electricity and transportation.[121] This security question is further exasperated by the declining native production leading to more reliance for imports. According to the EUR-Lex, the Russian-Ukrainian gas crisis in January 2009 has led to the repeal of the Council Directive 2004/67/EC, which although created the first legal framework for security of supply in the Union, resulted with insufficient implementation among member states and led to lacklustre readiness for the creation of an effective response for a crisis (EUR-Lex 2011, Background).[122]

The key milestones to remember in this regulation are as follows: First, the Article 6 on the infrastructure standard where it was deemed mandatory to have bi-direction capable border interconnections among member states.[123] This article effectively seeks for reverse-flow capable pipelines to alleviate the security of supply issues. As it is seen from the Figure 3.10, this regulation is the legal foundation for

[120] ibid.

[121] Regulation (EU) No 994/2010 of the European Parliament and of the Council of 20 October 2010 concerning measures to safeguard security of gas supply and repealing Council Directive 2004/67/EC Text with EEA relevance OJ L 295, 12.11.2010, p. 1–22

[122] "Security of Supply of Natural Gas." 2011. EUR-Lex. 2011. Accessed October 10, 2022. Available from: https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=CELEX:32010R0994.

[123] Regulation (EU) No 994/2010

reverse flow capable natural gas connections across the EU. The second milestone to remember is Article 8 on supply standard which sought the member states to have at least 30 days worth of stockpile for an emergency due to distruption on infrastructure or excessive high demand.[124]

In the last decade, further legislative actions on natural gas as an energy and raw resource has correlated more with the issues of security of supply as well as the climate change. In the year 2013, the Regulation (EU) No 347/2013 called Guidelines for trans-European energy infrastructure that led to the creation of Projects of Common Interests (PCIs). These PCIs aimed for more interconnection between the member states in various energy fields such as electricity, natural gas etc.[125] According to the EUR-Lex (EUR-Lex 2014, Summary), sustainment of the growth in the Union resided with increased attention towards the energy sector, hence, necessary infrastructure projects were needed to secure that goal.[126] Natural gas, as one of the ingredients for energy, was also covered by this regulation thus, projects such as TAP and TANAP were included in the EU PCI with this vision. Furthermore, more recently, two new projects of common interests were also commissioned. The PCI: 8.2.2: Enhancement of Estonia — Latvia interconnection and the PCI: 8.5 called Poland-Lithuania interconnection have enabled the EU network for natural gas to flow bi-directional towards and among the Baltic member states, making them more secure in terms of acquiring supply. (See Figure 3.17 that displays these new connection routes in the wider EU network.)

[124] ibid.

[125] Regulation (EU) No 347/2013 of the European Parliament and of the Council of 17 April 2013 on guidelines for trans-European energy infrastructure and repealing Decision No 1364/2006/EC and amending Regulations (EC) No 713/2009, (EC) No 714/2009 and (EC) No 715/2009 Text with EEA relevance OJ L 115, 25.4.2013, p. 39–75

[126] "Guidelines for Trans-European Energy Infrastructure." 2014. EUR-Lex. 2014. Accessed October 10, 2022. Available from: https://eur-lex.europa.eu/legal-content/en/LSU/?uri=celex:32013R0347.

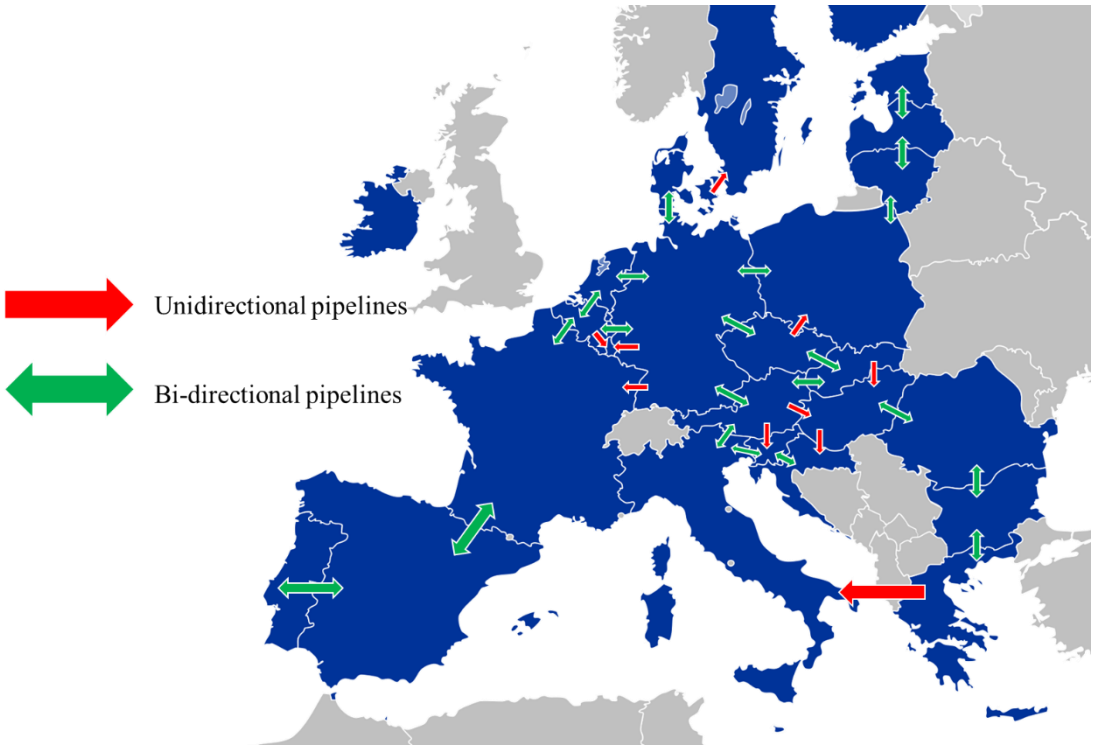


Figure 3.17: Updated Bi-directional Capacity of Pipelines Spanning Across the Member States of the European Union

Source: Author with the data obtained from ENTSOG, GIE and PCI Transparency platform of the European Commission

The other notable improvements happened in the last decade were the Commission Regulation (EU) 2015/703[127] that defined the standard measurement for the volume of natural gas; and the Regulation (EU) 2017/1938[128] which put forth the "Solidarity mechanism" to ensure that even in dire situations, the most vulnerable in other member states were given guarantees of supply.

Furthermore, Regulation (EU) 2018/1999 has established a governance mechanism in order to ensure member states to have a national energy and climate

[127] Commission Regulation (EU) 2015/703 of 30 April 2015 establishing a network code on interoperability and data exchange rules (Text with EEA relevance) C/2015/2823 OJ L 113, 1.5.2015, p. 13–2

[128] Regulation (EU) 2017/1938 of the European Parliament and of the Council of 25 October 2017 concerning measures to safeguard the security of gas supply and repealing Regulation (EU) No 994/2010 (Text with EEA relevance.) OJ L 280, 28.10.2017, p. 1–56

plan in the subsequent decades (Article 1, 3).[129] This regulation, coupled with Article 4 of the Regulation (EU) 2018/842, aimed for the reduction of greenhouse gas emissions by the member states down to 30% of their 2005 levels by 2030.[130]

For the case of pipelines, the Directive (EU) 2019/692, inferring from its 3rd to 13th points, have made amendments to Directive 2009/73/EC, which led to more oversight reaching to the third countries that the natural gas pipelines were originated from or acting as a transit country.[131] The directive sought to include these states in the previously mentioned "unbundling" process to ensure security of supply. This directive, although, did not include the already existing infrastructure for its immediate concern (like Nord Stream 1), it nonetheless, gave grounds for legal procedure for Nord Stream 2 project which was in the process of being constructed. The subsequent legal action petitioned by Gazprom-owned company, accused the European Union for breaching international law.[132] In the legal action between Nord Stream 2 AG and the European Union, the Nord Stream 2 company sought for the annulment of the directive in its entirety.[133] However, the final ruling on the case was the dismissal of the petition by the Court of Justice of the European Union on the grounds of being inadmissible,

[129] Regulation (EU) 2018/1999 of the European Parliament and of the Council of 11 December 2018 on the Governance of the Energy Union and Climate Action, amending Regulations (EC) No 663/2009 and (EC) No 715/2009 of the European Parliament and of the Council, Directives 94/22/EC, 98/70/EC, 2009/31/EC, 2009/73/EC, 2010/31/EU, 2012/27/EU and 2013/30/EU of the European Parliament and of the Council, Council Directives 2009/119/EC and (EU) 2015/652 and repealing Regulation (EU) No 525/2013 of the European Parliament and of the Council (Text with EEA relevance.) OJ L 328, 21.12.2018, p. 1–77

[130] Regulation (EU) 2018/842 of the European Parliament and of the Council of 30 May 2018 on binding annual greenhouse gas emission reductions by Member States from 2021 to 2030 contributing to climate action to meet commitments under the Paris Agreement and amending Regulation (EU) No 525/2013 (Text with EEA relevance) OJ L 156, 19.6.2018, p. 26–42

[131] Directive (EU) 2019/692 of the European Parliament and of the Council of 17 April 2019 amending Directive 2009/73/EC concerning common rules for the internal market in natural gas (Text with EEA relevance.) PE/58/2019/REV/1 OJ L 117, 3.5.2019, p. 1–7

[132] Gurzu, Anca. 2019. "Nord Stream 2 Sues the EU over New Gas Rules." *September 26*, 2019. Accessed October 10, 2022. https://www.politico.eu/article/nord-stream-2-sues-the-eu-over-new-gas-rules/.

[133] "Action Brought on 25 July 2019 – Nord Stream 2 v Parlement and Conseil (Case T-526/19)." 2019. Available from: https://curia.europa.eu/juris/document/document.jsf?text=&docid=217585&pageIndex=0&doclang=en&mode=req&dir=&occ=first&part=1&cid=1304798

which was delivered on 20 May 2020; making the action void and keeping the Directive 2019/692 in force.[134]

To summarise the subsection, the Figure 3.18 displays the timeline of important directives and regulations of the EU with their respective importance to the natural gas domain.

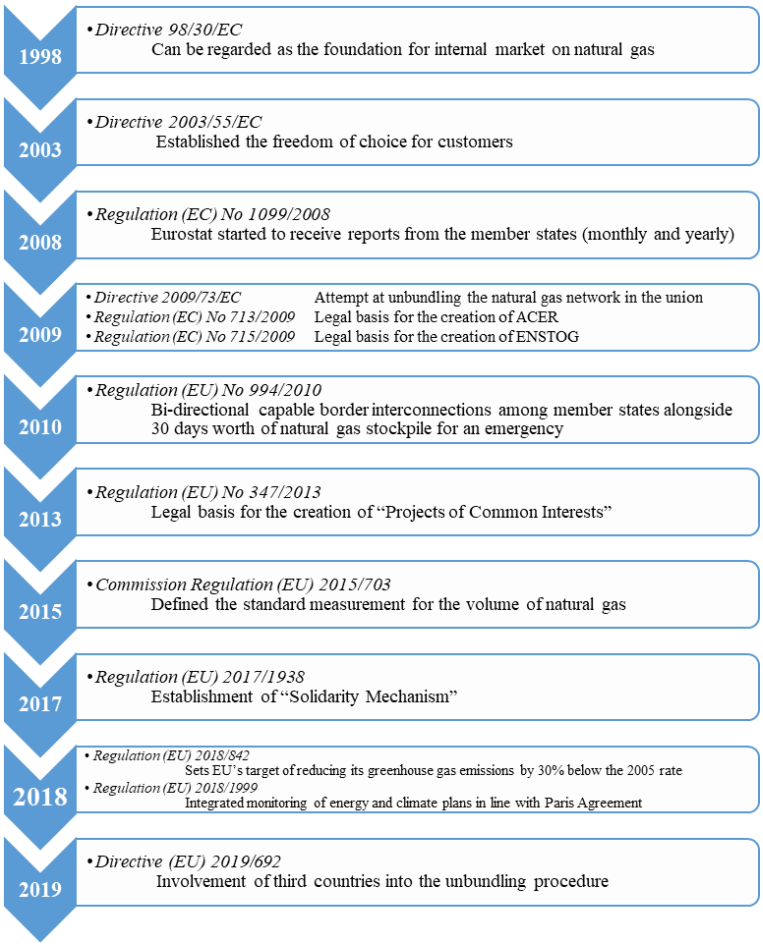


Figure 3.18: Timeline of Legal Acts Carried out by the European Union in Relation to Natural Gas

Source: Author with data obtained from EUR-Lex

[134] Order of the General Court (Eighth Chamber) of 20 May 2020.
Nord Stream 2 AG v European Parliament and Council of the European Union.
Action for annulment — Energy — Internal market in natural gas — Directive (EU) 2019/692 — Application of Directive 2009/73/EC to gas lines to or from third countries — No direct concern — Inadmissibility — Production of documents obtained unlawfully. Case T-526/19.

3.2.2. Recent Events Concerning the Natural Gas Domain

While the previous sub-chapter of this thesis focused on natural gas inside the scope of the European Union, contemporary events surrounding the same topic generally had a broader scale of implications. This section will attempt to shine a light on some of such events in order to achieve an overall understanding regarding natural gas in recent years. Some of the important events listed below are covered in the order of their occurrence.

3.2.2.1. EU-US LNG Contract

On 25 July 2018, during a visit between European Union and the United States officials in Washington, DC, both sides agreed to cooperate on many issues and released a joint statement.[135] While this joint statement covered topics such as reduction of tariffs and further cooperation on global security, the meeting can be viewed as a landmark for the significant change in the energy relations for both parties as well. Indeed, the remarkable increase in the bilateral LNG trade volume that took place after this joint statement is also evidenced in the report of the European Commission published in 2022.[136] Furthermore, the report also details the volumes of the trade in the last three consecutive years while also noting the 22.2 bcm trade volume that happened in 2021.[137] On both sides of the Atlantic, this bilateral cooperation promoted the security dimension of energy. This is evident in the words of Mark W. Menezes, the former Deputy Secretary of Energy of the U.S., who have

[135] "Joint U.S.-EU Statement Following President Juncker's Visit to the White House." 2018. Washington, DC. Accessed October 10, 2022. Available from: https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_18_4687.

[136] European Commission. "EU-U.S. LNG TRADE U.S. Liquefied Natural Gas (LNG) Has the Potential to Help Match EU Gas Needs." 2022. Accessed October 11, 2022. https://ec.europa.eu/energy/sites/ener/files/eu-us_lng_trade_folder.pdf.

[137] ibid.

used the term “freedom gas” and “molecules of U.S. freedom” to define U.S. natural gas exports to the EU.[138]

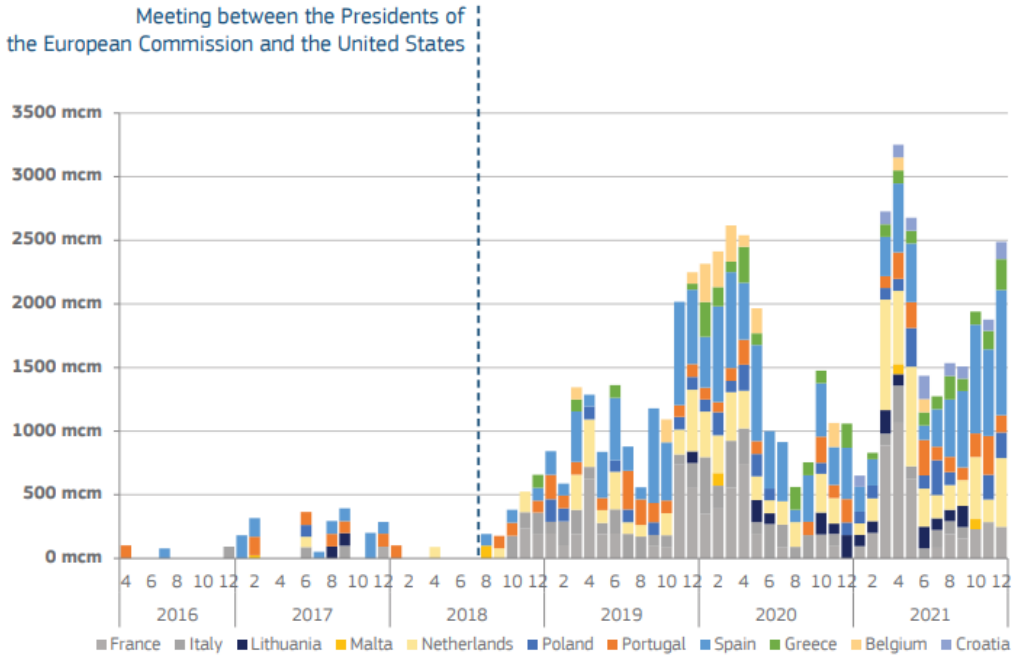


Figure 3.19: Semi-monthly Volumes of US LNG Exports to the European Union

Source: European Commission “EU-U.S. LNG TRADE” (Data until 10 January 2022)

3.2.2.2. COVID-19 Pandemic

The beginning of the new decade has brought a rather unpleasant gift to the world. On the eve of 2020, the World Health Organization’s (WHO) branch in China received cases of pneumonia related to an unknown cause.[139] While the WHO advised against any restrictions on travel or trade at the time, the situation grew rapidly as other countries started to confirm their own incidents.[140] Across the globe, countries started

[138] “Department of Energy Authorizes Additional LNG Exports from Freeport LNG.” Department of Energy. 2019. Accessed October 10, 2022. Available from: https://www.energy.gov/articles/department-energy-authorizes-additional-lng-exports-freeport-lng.

[139] “Pneumonia of Unknown Cause – China.” 2020. World Health Organization. 2020. Accessed October 6, 2022. Available from: https://www.who.int/emergencies/disease-outbreak-news/item/2020-DON229.

[140] ibid.

to employ travel restrictions and initiated lockdowns to slow down the spread of Coronavirus, also known as COVID-19. Europe has also experienced a significant share of the crisis and countries employed different strategies to reduce the further impact of the pandemic. In the case of energy, energy consumption rates of the countries with the lockdowns, ban on meetings and remote working conditions showed a noticeable drop. Even though the domestic demand for electricity has increased due to more time spent at home, it could not compensate for the downturn occurring in the industrial and commercial sectors.[141] This slowdown of the economy and consumption trends have led to a sharp decline for energy prices, which in turn, led to the lowest rates for both the natural gas and LNG.[142]

3.2.2.3. Price War Between Russia and Saudi Arabia

The relationship between oil and natural gas in terms of price fluctuations shows the characteristics of being connected, hence the inclusion of this issue in the research. This is mainly due to the indexation of LNG with the price of the former.[143] Perhaps one reason why this is the case could be the investing parties trying to secure themselves against the financial investment arising from the nature of LNG projects that require high capital. This price indexation situation is still prevalent in Asia; where domestic consumers mainly rely on the LNG to sustain their demands.[144] In the grand

[141] Bahmanyar, Alireza, Abouzar Estebsari, and Damien Ernst. 2020. "The Impact of Different COVID-19 Containment Measures on Electricity Consumption in Europe." Energy Research & Social Science 68: 101683. p. 2 Accessed October 8, 2022. https://doi.org/https://doi.org/10.1016/j.erss.2020.101683.

[142] Norouzi, Nima. 2021. "Post-COVID-19 and Globalization of Oil and Natural Gas Trade: Challenges, Opportunities, Lessons, Regulations, and Strategies." International Journal of Energy Research 45 (10): p. 14343. Accessed October 8, 2022. https://doi.org/10.1002/er.6762.

[143] Corbeau, Anne-Sophie, and David Ledesma. 2016. *LNG Markets in Transition: The Great Reconfiguration*. Paper presented at LNG18, Perth, Australia. 11-15 April 2016. p. 8 Accessed November 5, 2022. Available from: https://www.kapsarc.org/file-download.php?i=7514

[144] Foss, Michelle Michot, and Gürcan Gülen. 'Is U.S. LNG Competitive?' *IAEE Energy Forum* Q3 (2016): p. 33. Accessed October 10, 2022. Available from: https://www.iaee.org/en/publications/newsletterdl.aspx?id=342.;

Anne-Sophie, Corbeau. 'LNG Markets in Transition'. *Global Commodities Applied Research Digest* Spring (2017): p. 114. Available from: https://www.jpmcc-gcard.com/wp-content/uploads/2017/04/Page-112-116_GCARD-Spring-2017-Commentary-Corbeau.pdf.;

scheme of things, it is this linkage that puts any volatility in oil prices into the consideration for natural gas. Consequently, another event for us to take note of is the oil price clash that happened during March 2020. While situation was largely overshadowed by the impact of the Coronavirus getting more prevalent across the globe, the negative effect it had on the global natural gas domain is undeniable.

Russia and Saudi Arabia, both prevalent actors in the field of fossil fuels, have been in a common understanding position since 2016 to defend their interests in the market against rising U.S. shale production.[145] This partnership turned sour after the COVID-19 forced China -a major LNG importer- into a lockdown, making the demand for the oil drop significantly. With the price of the barrel of oil required for countries to make a profit and the political perspectives differing from one another, the OPEC+ meeting in Vienna resulted in a failure in addressing the problem.[146] Shortly after this breakdown of negotiations, Russia and Saudi Arabia both announced an increase in their production of oil, leading to a further price fall in the commodity. Indeed, the price of 50$ per barrel average stood somewhere around 10$ for the duration of March 2020. It was only after the involvement of the U.S. President at the start of the following month that the situation has resolved.[147]

Consequently, Till and McHich point out three things:[148] First, the effects of the price war experienced in the oil sector, coupled with COVID-19 pandemic, will lead to repercussions on gas domain in the following months. Second, during this time

---

IEA. 2019. *LNG Market Trends and Their Implications*. Paris: OECD. p. 3 License: CC BY 4.0 Accessed October 10, 2022. Available from: https://doi.org/10.1787/90c2a82d-en.

[145] Ma, Richie Ruchuan, Tao Xiong, and Yukun Bao. 'The Russia-Saudi Arabia Oil Price War during the COVID-19 Pandemic'. *Energy Economics* 102 (2021): 105517. p. 2 Accessed October 8, 2022. Available from: https://doi.org/https://doi.org/10.1016/j.eneco.2021.105517.

[146] Yergin, Daniel. *The New Map: Energy, Climate, and the Clash of Nations*. 1st ed. New York: Penguin Press, 2020. p. 312-313

[147] Ma, Richie Ruchuan, Tao Xiong, and Yukun Bao. 'The Russia-Saudi Arabia Oil Price War during the COVID-19 Pandemic'. *Energy Economics* 102 (2021): 105517. p. 3 Avaliable from: https://doi.org/https://doi.org/10.1016/j.eneco.2021.105517.

[148] Hilary, Till, and Adila McHich. 2020. "Is Oil-Indexation Still Relevant for Pricing Natural Gas?" CME Group. 2020. Accessed October 10, 2022. Available from: https://www.cmegroup.com/education/articles-and-reports/is-oil-indexation-still-relevant-for-pricing-natural-gas.html.

the market will already be in a different position, hence, it will create problems in adjustment period. Finally, they argue that these transitioning phases have increasingly reduced the relevance of oil indexation of natural gas. The last point, the future of the indexation of natural gas prices, was also shared by the IEA in its' 2020 report.[149]

3.2.2.4. Renewed Russo-Ukrainian Conflict

The final and perhaps the most crucial of the events concerning natural gas in global affairs is the Russian invasion of Ukraine. The first concrete indication of the invasion happened on 3 December 2021, when the United States intelligence, alongside the officials, had remarked on the possibility of such a notion.[150] Indeed, on 24 February 2022, the president of the Russian Federation, Vladimir Putin, gave the signal marking the beginning of a military operation in Ukraine.[151] An earlier conflict between Russia and Ukraine over the status of the Crimean Peninsula has played a significant part in the last decade in the security dimension of Europe. Thus, for many countries, this renewal of the aggression between the two parties has pushed security back on their agenda.

Ukraine, located in between the EU proper and Russia, plays a critical transit role for the Russian pipelines reaching Europe (see Figure 3.9). With the 13 members of the European Union obtaining the majority of their supply from Russia (see Figure 3.8), the negative implications of such a crisis are unmistakable. Although this conflict will have broader implications not just for the region but for the world itself, the thesis

[149] IEA. 2020. "Global Gas Security Review 2020." p. 16-18 Accessed October 10, 2022. Available from: https://iea.blob.core.windows.net/assets/15a3ec72-1bf2-47a1-8b6c-e45e858cfcd8/Global_Gas_Security_Review_2020.pdf.

[150] Harris, Shane, and Paul Sonne. 2021. "Russia Planning Massive Military Offensive against Ukraine Involving 175,000 Troops, U.S. Intelligence Warns." *The Washington Post*, December 3, 2021. Accessed October 10, 2022. Available from: https://www.washingtonpost.com/national-security/russia-ukraine-invasion/2021/12/03/98a3760e-546b-11ec-8769-2f4ecdf7a2ad_story.html.

[151] Troianovski, Anton, and Neil MacFarquhar. 2022. "Putin Announces Start to 'Military Operation' Against Ukraine." *The New York Times*, February 23, 2022. Accessed October 10, 2022. Available from: https://www.nytimes.com/2022/02/23/world/europe/ukraine-russia-invasion.html.

will limit itself to consider the actions taken by the European Union to maintain its general scope.

The European Union condemned the actions of the Russian Federation with a series of sanctions and statements vowing to reduce their dependency on Russian gas. On 8 March 2022, communication from the European Commission introduced REPowerEU Plan to initiate the decoupling of Russian imports of various fossil fuels.[152] The plan involved two main paths for the EU to achieve the goal.[153] The first, was the further diversification of gas suppliers via LNG and pipelines. The second part of the plan was to reduce the EU's overall dependence on fossil fuels. The REPowerEU was the action taken by the EU in order to protect the security of supply of natural gas which was under threat due to high imports from Russia. Three days later, on 11.03.2022, the informal meeting of the Heads of State or Government, held at Versailles, confirmed these overall goals of the EU by its leaders.[154] Following these developments, later in the same month, a proposal to increase the security of supply of natural gas was submitted by the Commission to amend Regulation (EU) 2017/1938 and Regulation (EC) n°715/2009.[155]

The culmination of these actions were two fold. The first was the solidification of the REPowerEU Plan by a communication dating 18.5.2022. According to this plan, the EU Energy Platform, -a newly created entity which held its first meeting on 8 April 2022- will unify the demand of the participating member states and seek LNG and hydrogen purchases from suppliers.[156] In the same way, the communication also points

---

[152] EUR-Lex. 'REPowerEU: Joint European Action for More Affordable, Secure and Sustainable Energy'. EUR-Lex, 2022. Accessed November 5, 2022. Available from: https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A108%3AFIN.

[153] ibid.

[154] European Council. 'The Versailles Declaration, 10 and 11 March 2022'. Versailles, 2022. p.5 Accessed October 11, 2022. Available from: https://www.consilium.europa.eu/media/54773/20220311-versailles-declaration-en.pdf.

[155] Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) No 715/2009 with regard to gas storage (Text with EEA relevance) PE/24/2022/INIT OJ L 173, 30.6.2022, p. 17–33

[156] Conti, Ilaria, and James Kneebone. 2022. "A First Look at REPowerEU: The European Commission's Plan for Energy Independence from Russia." *Florence School of Regulation,*

out the possibility of creating a new platform which may turn into a joint purchasing mechanism that can acquire a trans-governmental trait, thus, leading the gas negotiations on behalf of engaging member states.[157] The second key milestone was the approval of the aforementioned proposal in becoming a regulation by amending Regulation (EU) 2017/1938 and (EC) No 715/2009. Recalling back to Figure 3.18, the Regulation (EU) 2017/1938 has established a solidarity mechanism for the European Union. This new change, the Regulation (EU) 2022/1032, has set a binding target for the member states to have their underground natural gas storage to be at least filled up to 80% for the 2022.[158] Furthermore, the regulation also requires the member states to raise their stock levels to 90% starting in 2023.[159] Although there are some countries without any underground storage facilities to stock up on gas, the solidarity mechanism has enabled the allocation of already existing infrastructure to be used for the benefit of the whole. The following figure (see Figure 3.20) was given by the Commission to show which countries have the underground gas capacity and which ones are in solitary agreement with one another to mitigate the issue. It is therefore evident that all the members are covered by the solidarity protocol. Finally, this regulation came into effect as of 01/07/2022.

May 19, 2022. Accessed October 11, 2022. Available from: https://fsr.eui.eu/first-look-at-repowereu-eu-commission-plan-for-energy-independence-from-russia/.

[157] European Commission. 'Communication: REPowerEU Plan {SWD(2022) 230 Final}'. Brussels, 2022. p. 4-5 Accessed November 5, 2022. https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF.

[158] Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) No 715/2009 with regard to gas storage (Text with EEA relevance) *OJ L 173, 30.6.2022*, p. 17–33

[159] ibid.

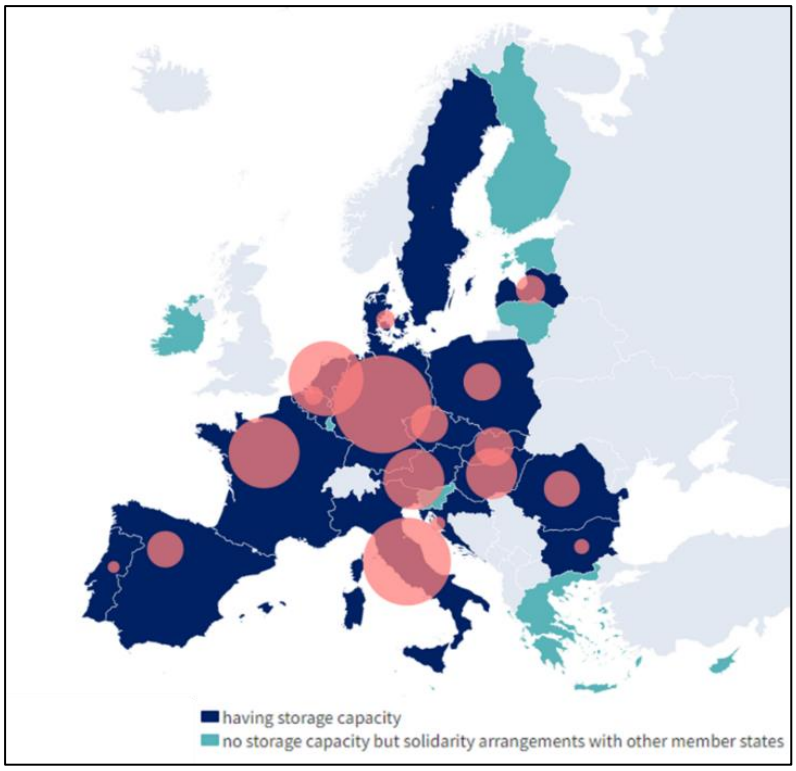


Figure 3.20: Gas Storage Capacity of EU Member States

Source: European Commission, March 2022

3.3. Conclusion

This chapter discussed the situation on the European Union by explaining the general capacity of the Union in terms of its production and consumption values by analyzing the Eurostat figures. The consumption figure (411.1 bcm), as explained in the chapter, uses gross inland consumption to comprehensively cover the need for natural gas since natural gas may be used in different fields other than as an energy source. The results for the year 2019 indicate that the EU can only cover 17% of its total natural gas consumption by its domestic production. The 30 year data obtained from Eurostat show that there is a decreasing trend in production which in turn will make the EU more dependent on imports in the future.

On the issue of imports, this chapter also explained the dependency ratio and attempted to give information on each member state with their production and their dependency. The research found that only Denmark and Malta have no dependency on natural gas imports. The country Denmark, possess enough production capability

to sustain its demand whereas the latter, Malta, does not use natural gas in its entirety hence, no demand for the said resource.

After this discussion, the chapter then delved deeper on the import side of natural gas in the EU and found that Russia covered the 42% of the total natural gas imports. While the ratio of imports from Russia is already significant by itself, the Eurostat also does not pinpoint the origin of more than 67 bcm of natural gas in their database. This figure is substantial when it is compared to the total of 440 bcm imports that occured during the 2019 and may hide the actual percentage, and the real significance of Russian imports.

The chapter, then, focused on the import capabilities of the European Union by looking at the capacities of the pipelines and the LNG regasification plants that are located within the EU. Due to the nature of the research question, the coverage of this study excluded the pipelines that bring gas from Russia. The total capacity of the pipelines, which are geographically divided into three groups, allow the transmission of 197.3 bcm of natural annually. This figure roughly corresponds to 48% of the 2019 natural gas gross inland consumption of the EU. Furthermore, the study also found that the total LNG capacity of the EU is at 165 bcm, which at full utilization, can cover 40.1% of the gross inland consumption. However, the actual 2019 LNG imports only reached somewhere around 87 bcm, making the LNG coverage of the 2019 gross inland consumption of the EU at 21.1%.

As for the second part of this chapter, the research focused on the legal processes that happened in the EU and investigated the recent events that showed importance in the field of natural gas. The legal acts that have occurred in the EU started with the liberalisation goals in the energy market with non-discrimination and openness towards newcomers in the field. The research also attempted to explain the idea of unbundling and its goals to eliminate the monopolies and its attempts at creating a free and competitive common market for the energy in the EU.

Furthermore in this part, the EU legal framework actions indicate that the security of supply for natural gas has also gained more prevalence due to the citings on the diminishing performance in domestic production of the natural gas. Moreover, we see that the security of supply and common market goals of the EU has led to the creation of EU-wide info gathering on energy statistics and realisation of entities such

as ACER and ENTSOG. These entities play an important role for the EU as they are tasked with the creation of an EU-wide infrastructure and market rules along with publishing yearly reports and development plans respectively.

Some of issues relating to Russia were also mentioned in this part such as the reaction of the EU following the gas crisis of 2009 and legal action taken by the Nord Stream 2 and Russian-Ukrainian War of 2022. The gas crisis has led the EU to establish bi-directional capability by refiting the pipelines between the member states. This action enabled natural gas to be sent in both directions, thus, the flow can be reversed in an event of need. Furthermore, the EU also started to stock up at least 30 days of stockpile of natural gas for similar cases that can occur in the future. The establishment of solidarity mechanism is also addressed in this chapter where all the member states ensure that they would try to help one another in an event of emergency. This solidarity protocol, with the consensus established by the REPowerEU plan, was strengthened after the second Russian invasion of Ukraine in 2022. Indeed, the second invasion has also resulted with EU member states agreeing to raise their gas stockpiles to be filled up to 80% of their capacity for the year 2022, and 90% for 2023 and onwards.

As for the other events preceding the invasion, the US-EU LNG contract that was signed in 2018 showed a remarkable increase in US LNG exports to the Union. As both sides are on similar stances towards Russia, this cooperation is likely to expand and deepen the ties. Events such as the COVID-19 Pandemic and the Price War between Russia and Saudi Arabia have not only led to decrease in demand, but also lowered the price for natural gas.

CHAPTER 4

ALTERNATIVES

With the completion of the topics covered in the previous chapters, one has gained the necessary information to evaluate the overall picture accurately. Indeed, the earlier chapters of the research have tried to dispel the mystery of energy-related concepts and definitions. The requisite explanations such as the gross inland consumption, capacities of the pipelines and the storage facilities that give the raw data can now be coupled with the Union's legal context and its reactions to the events surrounding the topic. With the journey of covering natural gas along with its relation to the European Union is now over, this chapter of the research will attempt shine a light on some of the alternatives that are available for the Union in reducing its natural gas dependency to Russia.

4.1. Further LNG Imports

While the Versailles Declaration mentioned an overall reduction in fossil fuel reliance for the European Union, it also indicated the intent of diversification in LNG alongside with creation of new infrastructures.[160] This action give the possibility that the LNG will be one of the alternatives that are considered by the EU to reduce its natural gas dependency on Russian imports.

As of 2022, the EU's annual importation capacity of LNG stands at ≈157 bcm.[161] This rate corresponds to %40 of the total gross inland consumption of the union if it is assumed to be at 400 bcm.[162] However, as mentioned before, the actual

[160] European Council. 2022. "The Versailles Declaration, 10 and 11 March 2022."

[161] European Commission. 'Liquefied Natural Gas'. European Commission. Accessed 10 October 2022. Infrastructures section. https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en.

[162] ibid. Consumption and demand section.

utilisation rates of the terminals remain well below their full capacity (see chapter 3.1.2). The Table 4.1. illustrates the top eight LNG partners of the European Union between the years 2018-2020, all of which have volumes of trade going above 1 bcm.

Table 4.1: Top 8 Partners of the EU-27 According to the Amount of Imported LNG between 2018-2020 (in million cubic metres)

Partners	2018	Partners	2019	Partners	2020
Qatar	16,326.950	**Qatar**	21,103.304	**Qatar**	16,385.181
Nigeria	9,855.807	**Russia**	14,653.145	**United States**	15,682.140
Algeria	6,951.721	**Nigeria**	13,436.157	**Russia**	13,270.438
Russia	5,043.968	**United States**	12,560.315	**Nigeria**	11,460.990
Norway	3,844.874	**Algeria**	8,880.912	**Algeria**	7,754.754
United States	2,440.930	**Norway**	5,500.068	**Norway**	3,954.320
Trinidad and Tobago	2,294.796	**Trinidad and Tobago**	4,752.180	**Trinidad and Tobago**	3,112.854
Peru	1,774.000	**Egypt**	1,306.531	**Equatorial Guinea**	1,129.670

Source: Eurostat

As of 10/10/2022, the actual values for the 2021 rates do not yet exist in Eurostat. However, European Commission's website indicate that the total LNG imports for the year 2021 were around 80 bcm. (gas equivalent), which is comparable to the 2020 total of 79.2 bcm. (European Commission n.d., Importance of LNG for the EU's security of supply).[163] Further inspection of the details has revealed the change in the top position. Indeed, according to the same web page, the United States took over the majority share of the EU's LNG imports by reaching 28% of the total. Qatar and Russia, on the other hand, achieved somewhere around 20% of the total, whereas, Nigeria and Algeria have retained their position with 14% and 11% respectively.[164]

The BP ranking, which was in chapter 2.3.2, showed the largest LNG exporters in the world. By comparing the data given by the Eurostat and the BP, we see among the top five on BP's report that, only Qatar, the United States, and Russia are conducting significant LNG trade with the EU. Since the renewed tension concerning

[163] ibid.

[164] ibid.

Russia is going to affect the import rates, further inspection of other countries is crucial in examining the future prospects of the LNG imports. On the subject of the BP's top LNG exporters, while Australia and Malaysia have a significant rate of LNG exports, their distance acts as a barrier and limits the access to the EU market. The issues of distance and Asian markets dominance in LNG domain were partially explained in the chapter 2.3.2. As for the case of Australia, selling LNG to Asian markets seems to be priority for the next 30 years.[165] Furthermore, this proximity issue affecting the direction of LNG destinations coming from Australia and Malaysia is also observed and confirmed by Vivoda.[166] Thus, this section will only extensively cover the already trading partners such as Qatar and the United States.

4.1.1 The United States

The shared values and historical bonds between the European Union and the United States do not require any introduction. The latter counterpart, however, signifies a crucial role in the natural gas domain since its utilisation of the unconventional method for the extraction of fossil fuels in the early 2000s. As briefly explained in chapter 2.4., the unconventional method for extracting fossil fuels in the United States has played a crucial role in the reversal of country's dependence towards these fuels. Having experienced more consumption than production since 1960, US natural gas became the first sector to reverse this process in 2017 (see Figure 4.1).[167]

---

[165] Australian Government. 'Global Resources Strategy Commodity Report: Liquefied Natural Gas'. Department of Industry, Science and Resources, 2022. p. 11-17. Accessed October 11, 2022. Available from: https://www.industry.gov.au/sites/default/files/2022-09/grs-commodity-report-lng.pdf.

[166] Vivoda, Vlado. 'LNG Export Diversification and Demand Security: A Comparative Study of Major Exporters'. *Energy Policy* 170 (November 2022): 113218. p. 3-7. Accessed October 11, 2022. Available from: https://doi.org/10.1016/j.enpol.2022.113218.

[167] EIA. 'Natural Gas Explained: Natural Gas Imports and Exports'. EIA, n.d. Accessed November 5, 2022. Available from: https://www.eia.gov/energyexplained/natural-gas/imports-and-exports.php.

Similarly, the US oil sector achieved its independence in 2020.[168] Returning back to the natural gas sector, Yergin points out that experts' expectations prior to surge of the unconventional extraction was that the US would be more dependent on gas imports, similar to what it was in the case of oil up to that point.[169]

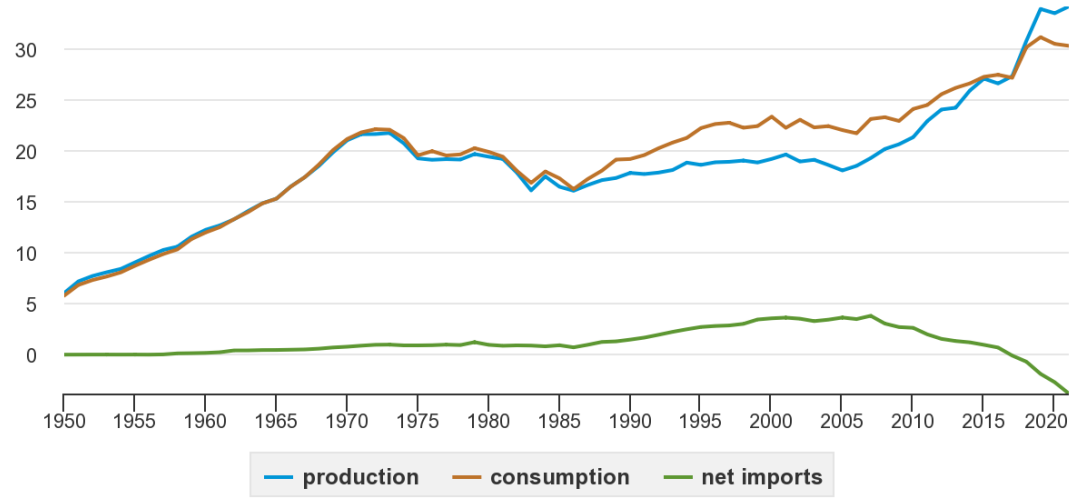
The bilateral relationship between the US and the EU resulted with both sides agreeing on increased energy cooperation and the creation of Energy Council.[170] As mentioned in chapter 3.2.2.1., thanks to the LNG agreement signed between the two parties in 2018, we can say that the natural gas relationship between the United States and the European Union has been on a positive trend. Referring back to the US-EU LNG Partnership, according to the factsheet published by the European Commission in February 2022, the US is not only the leader in natural gas production, but also indicates its intent to increase its production and exports further.[171] Similarly, the paper also shows a growing LNG traffic between the two entities, hence, it is not wrong to assume that the positive trend that is observable between the US and the EU paints a picture of further cooperation. Likewise, this trend may also further accelerate as the Russian aggression on Ukraine is opposed by both parties.

[168] EIA. 'Oil and Petroleum Products Explained: Oil Imports and Exports'. EIA, n.d. Accessed October 11, 2022. Available from: https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php.

[169] Yergin, Daniel. 2020. "The New Map: energy, climate, and the clash of nations." Chapter 2.

[170] Council of the European Union. 'EU-US Summit'. Washington, DC, 2009. p. 11. Accessed November 5, 2022. Available from: https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/er/110929.pdf.

[171] European Commission. 'EU-US LNG TRADE', 2022. p. 1-2. Accessed October 11, 2022. Available from: https://energy.ec.europa.eu/system/files/2022-02/EU-US_LNG_2022_2.pdf.



Data source: U.S. Energy Information Administration, *Natural Gas Monthly*, March 2022, preliminary data for 2021

Figure 4.1: U.S. Natural Gas Consumption, Dry Production, and Net Imports 1950-2021 (In Trillion Cubic Feet)

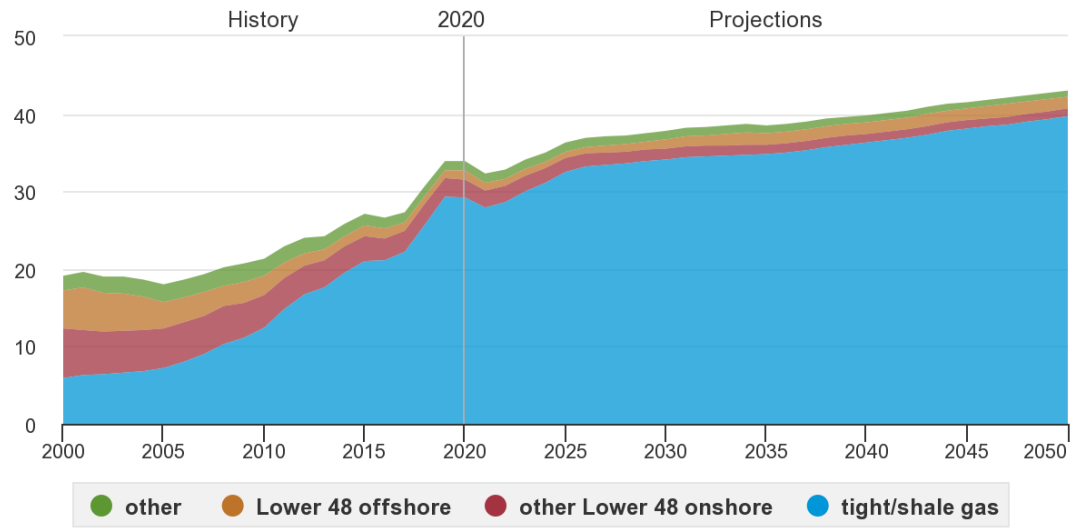
Source: EIA, March 2022

Nevertheless, there are some constraints in the case of the United States for its future exports of natural gas. This section in the study will attempt to name a few to show the potential limitations of the US in the natural gas domain.

What might be the success story of gas extraction in the US is in reality, a double edged sword. As seen in the figure 4.2, the US has achieved its natural gas independence by relying heavily on unconventional methods. Recall from the chapter 2.4. that the unconventional methods of resource extraction is comperatively costlier than conventional methods. Even this is the case, the US persisted on utilizing this method to great extent. The EIA graph show that the 86% of US natural gas production in 2020 came from unconventional methods (See figure 4.2). This upward trend is facilitated by the optimistic rhetroric of both the politicans and the industy which indicated positive economic promises for the future.[172] As the energy prices show a

[172] Kelsey, Timothy W., Mark D. Partridge, and Nancy E. White. 2016. "Unconventional Gas and Oil Development in the United States: Economic Experience and Policy Issues." *Applied Economic Perspectives and Policy* 38 (2): p. 192. Accessed October 12, 2022. Available from: https://doi.org/10.1093/aepp/ppw005.

positive correlation with the extraction rate,[173] the US benefited from the viable market conditions (see Figure 4.1).



Data source: U.S. Energy Information Administration, *Annual Energy Outlook 2021 Reference case*, February 2021
Note: *Other* includes Alaska and coalbed methane.

Figure 4.2: U.S. Dry Natural Gas Production by type, 2000-2050 (In Trillion Cubic Feet)

Source: EIA, March 2022

On the negative side of the coin, however, the commercial viability of unconventional extraction methods seen in the US also brings the question of volatility to the forefront. Although these methods helped the US in achieving its energy independence, the price for such action resulted in higher costs. On the issue of costs, the distance that US natural gas needs to cover to supply Europe also necessitates the utilisation of LNG method (see Chapter 2.3.2.). Recall from the chapter 2.2. that, the of cooling and liquifying natural gas is tremendously expensive.[174] Thus, the US not only relies on the expensive methods to produce gas, it also bears the cost of liquifying to ship it overseas. Consequently, the glut that ensued during COVID-19 and Oil Price War have negatively impacted the production of natural gas in the US with active rigs

[173] ibid. p. 199.

[174] Kavalov, Boyan, Hrvoje Petrić, and Aliki Georgakaki. "Liquefied Natural Gas For Europe – Some Important Issues For Consideration".

sharply decreasing during the period of unprofitability and uncertainty (See figure 4.3). Recall the proved reserves terminology explained in chapter 2.1.1. -while the natural gas production did not significantly drop- persisting low prices may hurt the prospect of future extraction endeavours. It is, therefore, noteworthy to remember that the United States is much more vulnerable to price fluctuations when compared to the countries. This is especially apparent in the case against Qatar which has the lowest price ceiling for natural gas production.[175]

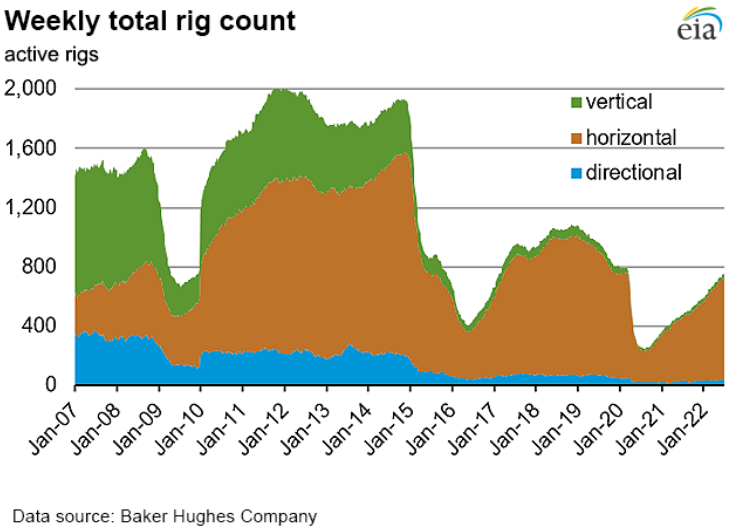


Figure 4.3: Weekly Active Rig Count
Source: EIA, March 2022

Coming to 2022, the highly volatile position of natural gas sector in the country might get a respite as the Russian invasion of Ukraine and the subsequent EU position favouring imports from the US to curb Russian supply. The effects of Russian invasion are two-fold. Firstly, the Russian conflict with Ukraine has crucially reversed the tide of the sluggish pace of natural gas prices in 2022, hence, the commercial viability of US gas is improved. Secondly, with the EU decision-makers agreeing on reducing their fossil fuel imports from Russia (see REpowerEU), a significant amount of gas

[175] Meza, Abel, and Muammer Koç. 'The LNG Trade between Qatar and East Asia: Potential Impacts of Unconventional Energy Resources on the LNG Sector and Qatar's Economic Development Goals'. *Resources Policy* 70 (March 2021): 101886. p. 2. Accessed October 12, 2022. Available from: https://doi.org/10.1016/j.resourpol.2020.101886.

supply needs to be replaced by other actors; thus, the US can corner at least a significant part of the EU market with its exports.

The initial idea in the research is that the Russian aggression on Ukraine will undoubtedly further the energy links of the EU with the United States and the actions taken by both parties support this idea. This is further apparent in the declared joint statement between the EU and the US dating 28 January 2022.[176] According to the statement, in the quest to reduce its dependence on Russia, the European Union is actively looking for more cooperation with the United States.[177] Similarly, another joint statement made by US President Joe Biden and the European Commission President Ursula von der Leyen on 25 March 2022.[178] During her statement, President Ursula von der Leyen said:

> Therefore, the US commitment to provide the European Union with additional, at least, 15 billion cubic metres of LNG this year is a big step in this direction. Because this will replace the LNG supply we currently receive from Russia. And looking ahead, the United States and Europe will ensure stable demand and supply for additional, at least, 50 billion cubic metres of US LNG until 2030. And if we look at that, this amount, 50 bcm per year, is replacing one third already of the Russian gas going to Europe today.

This goal of an increase in LNG exports from the United States, which is striving to reach somewhere around 37.2 bcm for the year 2022, will likely lead to the reallocation of already dedicated capacity from Asia towards Europe as the utilisation of US LNG liquefaction facilities are already at high levels.[179] The said capacity received a significant dent on 8 June 2022 as a fire occurred in one of the liquefaction facilities leading to the complete cessation of the facility until late 2022. The Freeport

---

[176] European Commission. 'Joint Statement by President von Der Leyen and President Biden on U.S.-EU Cooperation on Energy Security'. Brussels, 2022. Accessed October 12, 2022. Available from: https://ec.europa.eu/commission/presscorner/api/files/document/print/en/statement_22_664/STATEMENT_22_664_EN.pdf.

[177] ibid

[178] European Commission. 'Statement by President von Der Leyen with US President Biden'. Brussels, 2022. Accessed October 12, 2022. Available from: https://ec.europa.eu/commission/presscorner/detail/en/statement_22_2043.

[179] Davies, Rob. 'Biden and EU Agree Landmark Gas Deal to Break Kremlin's Hold'. *The Guardian*, 25 March 2022. Accessed October 12, 2022. Available from: https://www.theguardian.com/us-news/2022/mar/25/biden-and-eu-agree-landmark-gas-deal-to-break-kremlin-hold.

LNG, the aformentioned liquefaction plant, is one of the seven plants operating in the US and accounts for 17% of the total LNG export capacity of the country.[180] Since then, the LNG shipments from the US that went to Europe has increased and reached 70% of share in the total US exports for the month of October by culling the supply from other markets such as Asia and Latin America.[181]

Overall, for the case of further LNG imports from the United States as an alternative, we see that the country is displaying preference in supplying the EU even during times of adversity. The continual relationship between the leadership on both sides indicates that the US will take significant role in helping the EU to reduce its dependency on Russia. However, it is also important to note that US production, which is shouldering the premium in extracting and transforming natural gas, is vulnerable to the changes in both oil and the gas sector as explained above. Thus, retention of the high prices for gas markets in demand will likely to shape the overall contribution of the country in the long term.

4.1.2. Qatar

The State of Qatar is also an important LNG supplier in the world. The country held the third largest proved reserves for natural gas at the end of 2020 with 24.7 trillion cubic metres, which was approximately 13.1% of the total in the world.[182] Qatar produced 174.9 billion cubic metres of natural gas in 2020 and 177 bcm in 2021.[183] While the BP report relased in 2022 does not include the adjusted R/P ratio, with the calculation explained on chapter 2.1.3., we see that Qatar with its 2021

[180] EIA. 'Fire Causes Shutdown of Freeport Liquefied Natural Gas Export Terminal', 2022. Accessed October 12, 2022. Available from: https://www.eia.gov/todayinenergy/detail.php?id=52859.

[181] Parraga, Marianna. 'More U.S. LNG Heads to Europe despite Output Constraints'. *Reuters*, 3 October 2022. Accessed October 12, 2022. Available from: https://www.reuters.com/business/energy/more-us-lng-heads-europe-despite-output-constraints-2022-10-03/.

[182] BP. 'Statistical Review of World Energy' 70 (2021): p. 34. Accessed October 13, 2022. Available from: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-natural-gas.pdf.

[183] BP. 'Statistical Review of World Energy' 71 (2022): p. 29. Accessed October 13, 2022. Available from: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf.

production rate can sustain its natural gas extraction for around 137 years. The history of natural gas in Qatar corresponds to the year 1971 with the discovery of the offshore field North Field.[184] Since the country does not possess any pipelines that reach EU member states, any natural gas trade to the continent can only be conducted by the use of the LNG method. The year 1996 marked the first usage of LNG, with the first shipment destined for Japan.[185]

Qatar, through long term planning and investments in the LNG chain, managed to achive lower costs and greater flexibility.[186] This flexibility in price and non-pipeline structure of the country meant that the Qatari gas mainly catered the needs of the Asian region due to its premium in prices.[187] Indeed, 72% of the 2021 LNG shipments of the country had their destinations in the Asia Pacific region.[188] Still, as Corbeau and Ledesma pointed out, all of the Qatari gas that is destined for Asian market is not out of the picture as the year 2015 has shown.[189]

Further closer to our time, Qatar declared its intention to expand the production of LNG in the North Field in 2017. This expansion aims to increase the county's LNG capability from 77 million tons (around 100.1 bcm/y) to 126 million tons (around 163.8 bcm/y) by 2027.[190] This will ultimately expand the capability of the country to

---

[184] Qatargas. 'History'. Accessed 12 October 2022. Available from: https://www.qatargas.com/english/aboutus/history.

[185] ibid.

[186] Meza, Abel, and Muammer Koç. 'The LNG Trade between Qatar and East Asia: Potential Impacts of Unconventional Energy Resources on the LNG Sector and Qatar's Economic Development Goals'. *Resources Policy* 70 (March 2021): 101886. p. 3. https://doi.org/10.1016/j.resourpol.2020.101886.

[187] ibid. p. 3

[188] BP. 'Statistical Review of World Energy' 71 (2022): p. 36. Accessed October 13, 2022. Available from: https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf.

[189] Corbeau, Anne-Sophie, and David Ledesma. 'LNG Markets in Transition: The Great Reconfiguration', p. 12. Perth, 2016. Available from: https://www.kapsarc.org/file-download.php?i=7514.

[190] Nehme, Dahlia. 'Qatar Plans to Boost LNG Production to 126 Million Tonnes by 2027'. *Reuters*, 25 November 2019. Accessed October 13, 2022. Available from: https://www.reuters.com/article/qatar-energy-qp-idINKBN1XZ1HM.

export more natural gas to the EU member states. As mentioned in the US section, Qatar has the lowest costs for producing LNG and has significant reserves to continue its operations viably. With these cushioning factors, the country can play a higher role in supplying the EU's increasing demands. This is already an ongoing occurrence with the shipments on the month of January 2022 showing 65.1% increase from the last year.[191]

4.2 Potential New Pipelines

Another alternative that can help alleviate the EU's natural gas dependency on Russian exports is the possible new pipelines that will reach the continent. These gas pipelines, unlike the readily available LNG, will require construction, therefore, can not assist the short-term goals of the EU.

The first of the potential candidates is the Trans-Saharan Pipeline, with its 30 bcm a year capacity.[192] This 4,128 km long onshore pipeline will start in Nigeria and reach Algeria, with Niger acting as a transit country.[193] The proposed final destination of the project, Hassi R'Mel, can redistribute the Nigerian gas towards Europe via its numerous connections. In February 2022, the energy ministers of Nigeria, Niger and Algeria signed a signature of an accord to revive the project during the meeting of the third Mining and Petroleum Forum of the Economic Community of West African States (ECOWAS.[194] More recently, in another meeting held among the ministers on 20 June 2022, the trio pledged to start the development of the pipeline as soon as possible.[195]

---

[191] Qarjouli, Asmahan. 'Qatar's LNG Exports to Europe Increase in January amid Rising Demand'. *Dohanews*, 21 February 2022. Accessed October 13, 2022. Available from: https://dohanews.co/qatars-lng-exports-to-europe-increase-in-january-amid-rising-demand/.

[192] Schwikowski, Martina. 'African Countries Seek to Revive Trans-Saharan Gas Pipeline Dream'. *DW*, 12 August 2022. Accessed October 13, 2022. Available from: https://p.dw.com/p/4FPbN.

[193] ibid.

[194] MMEC. 'Mozambique International Mining & Energy Conference and Exhibition', 2022. Accessed October 13, 2022. Available from: https://mozambiqueoilmining.com/industry_news/the-signature-of-the-multibillion-dollar-trans-saharan-gas-pipeline-a-major-outcome-of-ecomof-2022/.

[195] Elliot, Stuart. 'Algeria, Niger, Nigeria Pledge Acceleration of Work on Trans-Saharan Gas Link'. *S&P Global*, 21 June 2022. Accessed October 13, 2022. Available from:

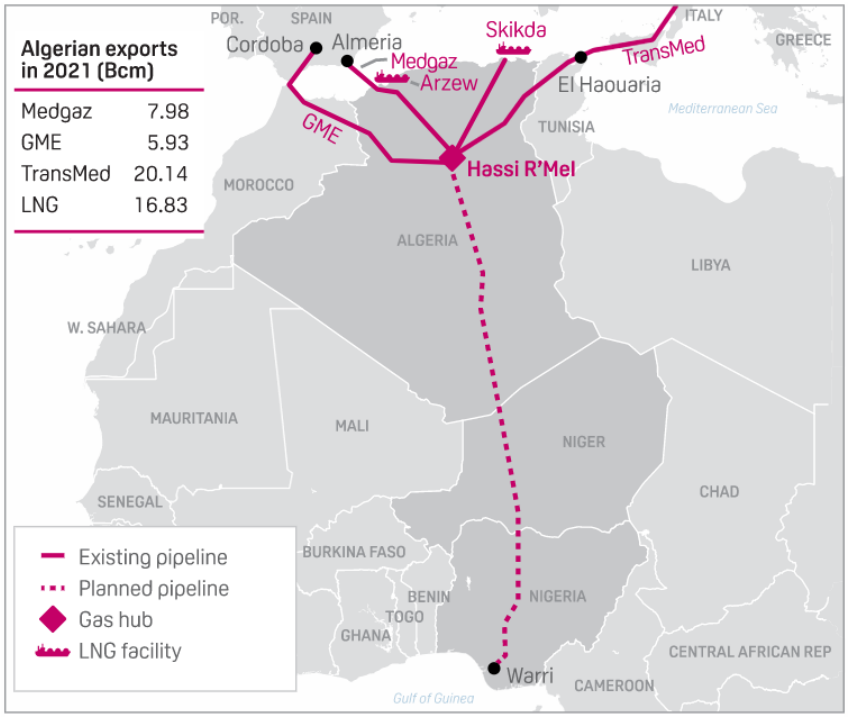


Figure 4.4: (Potential) Planned Path of the Trans-Saharan Pipeline
Source: S&P Global Commodity Insights

The second candidate is the further expansion along the Southern Gas Corridor which will reach and connect to Turkmenistan. Turkmenistan holds 13.6 trillion cubic metres of proven reserves of natural gas and produced 59 bcm in 2020.[196] On the export side, the country sent the majority of natural gas to China with 27.2 bcm.[197] The stagnant European demand in the past and infrastructure problems acted as barriers for Turkmenistan to diversify its portfolio toward the West.[198] However, the recent

https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/062122-algeria-niger-nigeria-pledge-acceleration-of-work-on-trans-saharan-gas-link.

[196] BP. 'Statistical Review of World Energy' 70 (2021): p. 2-4. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-natural-gas.pdf.

[197] ibid. p. 13.

[198] Tagliapietra, Simone. 'Turkey as a Regional Natural Gas Hub: Myth or Reality? An Analysis of the Regional Gas Market Outlook, Beyond the Mainstream Rhetoric'. *SSRN Electronic Journal*, 24 January 2014. p. 13. Accessed October 13, 2022. Available from: https://doi.org/10.2139/ssrn.2384492.

conflict between Russia and Ukraine has the potential to revive this demand, and it can enable Turkmenistan as an actor.

The potential linking of Turkmenistan with Azerbaijan via the Caspian Sea can occur in two instances. According to the Project of Common Interest No 7.1.1, the first one is a creation of a branch pipeline directly from the Turkmenistani East-West pipeline that has the capacity to deliver 32 bcm of natural gas annually.[199] This would require an underground pipeline in the Caspian Sea with a span of 300 kilometres and joining it to the SCP directly to link up with the Eastern Route discussed in this research (see Chapter 3.1.4).

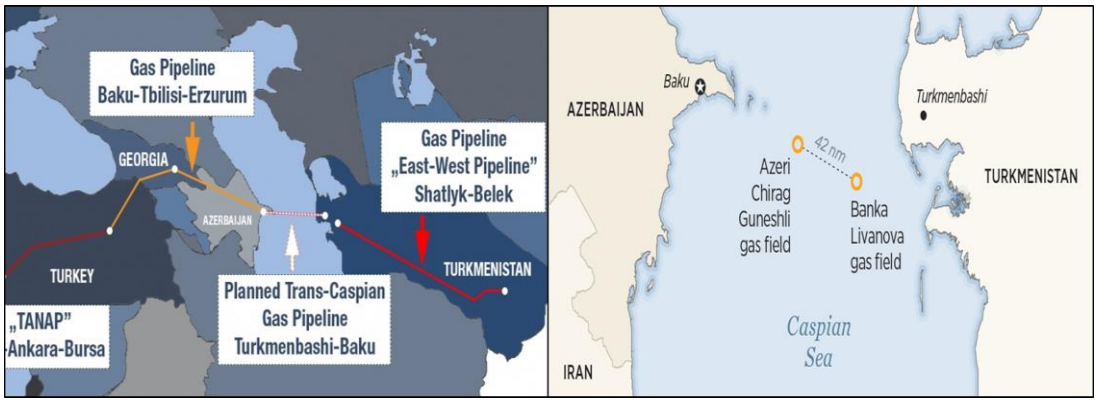


Figure 4.5: (Potential) Planned Paths for the Trans-Caspian Pipeline
Source: Crimean News Agency; Trans Caspian Resources, Inc

The second viable possibility discussed by the Project of Common Interest is the connection between the Turkmenistani offshore terminal with the Sangachal Terminal in Azerbaijan.[200] An adapted version of this plan is advocated by a US-based Trans Caspian Resources company. The capacity of the so called "Trans-Caspian Interconnector" project could allow Turkmenistan to bring 10-12 bcm of natural gas a year and would only require a 67.5 km connection.[201]

[199] European Commission. 'Project of Common Interest: 7.1.1 : Southern Gas Corridor', 2022. Accessed October 13, 2022. Available from: https://ec.europa.eu/energy/maps/pci_fiches/PciFiche_7.1.1.pdf.

[200] ibid.

[201] O'Byrne, David. 'New American Company Seeks to Realize Trans-Caspian Pipe Dream'. *Eurasianet*, 1 December 2021. Accessed October 13, 2022. Available from: https://eurasianet.org/new-american-company-seeks-to-realize-trans-caspian-pipe-dream.;

The third pipeline that can help alleviate EU's dependency is the recently sped-up Baltic Pipe Project between Denmark and Poland. Recall from the figure 3.17 that there is no operational infrastructure between Denmark and Poland, yet, the project aims to establish a bi-directional capable offshore pipeline that can enable direct connection.[202] Furthermore, the capacity of the pipeline is expected to operate at 10bcm a year.[203] While both countries are members of the EU, the Denmark end of the pipeline is also going to connect with Norway's Europipe II via an extension.[204]

On 24th September 2022, the Danish system operator Energinet, indicated that the project will be partially operational from October and reach full capacity starting from January 2023.[205] Indeed, the pipeline was inaugurated by the leaders of Norway, Denmark and Poland on 27th September and started to deliver natural gas to Poland.[206]

Devonshire-Ellis, Chris. 'Turkmenistan Becomes New Hunting Ground For EU Gas Supplies'. *Silk Road Briefing*, 31 March 2022. Accessed October 13, 2022. Available from: https://www.silkroadbriefing.com/news/2022/03/31/turkmenistan-becomes-new-hunting-ground-for-eu-gas-supplies/.

[202] Baltic Pipe Project. 'The Baltic Sea Offshore Pipeline'. Baltic Pipe Project. Accessed 12 October 2022. https://www.baltic-pipe.eu/dk/the-project/baltic-sea-offshore/.

[203] ibid.

[204] Baltic Pipe Project. 'The Project'. Accessed 13 October 2022. https://www.baltic-pipe.eu/the-project/.

[205] Baltic Pipe Project. 'ENERGINET: Baltic Pipe Can Be Put into Full Operation One Month Ahead of Planned'. *Baltic Pipe Project*, 24 September 2022. Accessed October 19, 2022. Available from: https://www.baltic-pipe.eu/energinet-baltic-pipe-can-be-put-into-full-operation-one-month-ahead-of-planned/.

[206] Sandford, Alasdair. 'Baltic Pipe: Norway-Poland Gas Pipeline Opens in Key Move to Cut Dependency on Russia'. *Euronews*, 27 September 2022. Accessed October 13, 2022. Available from: https://www.euronews.com/2022/09/27/baltic-pipe-norway-poland-gas-pipeline-opens-in-key-move-to-cut-dependency-on-russia.

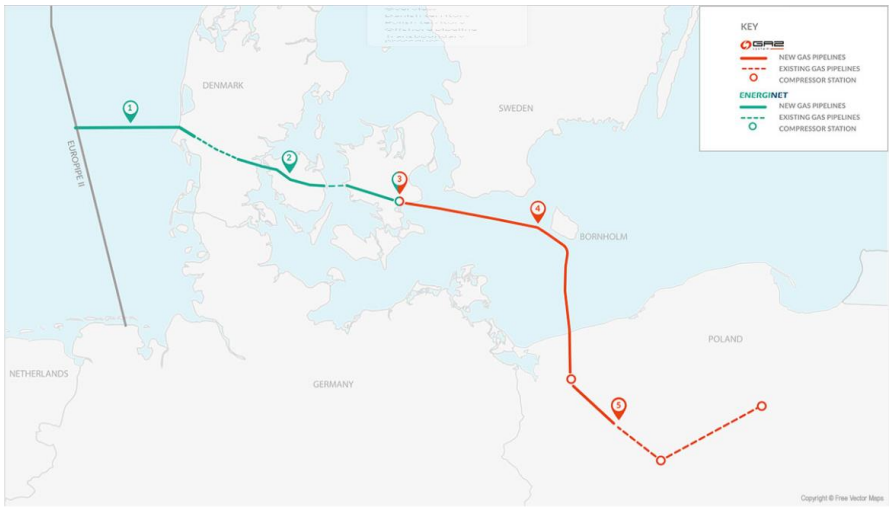


Figure 4.6: Baltic Pipeline Project Route
Source: Baltic Pipeline Project

4.3. Going Green

Using climate friendly/renewable sources for energy demand is also a possibility that the EU pursues in order to reduce its demand for fossil fuels. Usage of wind, solar, tidal, hydroelectricity, and other technologies not only create energy but they also do so without damaging the environment as fossil fuels do. The share of energy from renewable means in the EU has increased over the period of 15 years, reaching 22.1% in 2020 from 10% back in 2005 (see Figure 4.7).

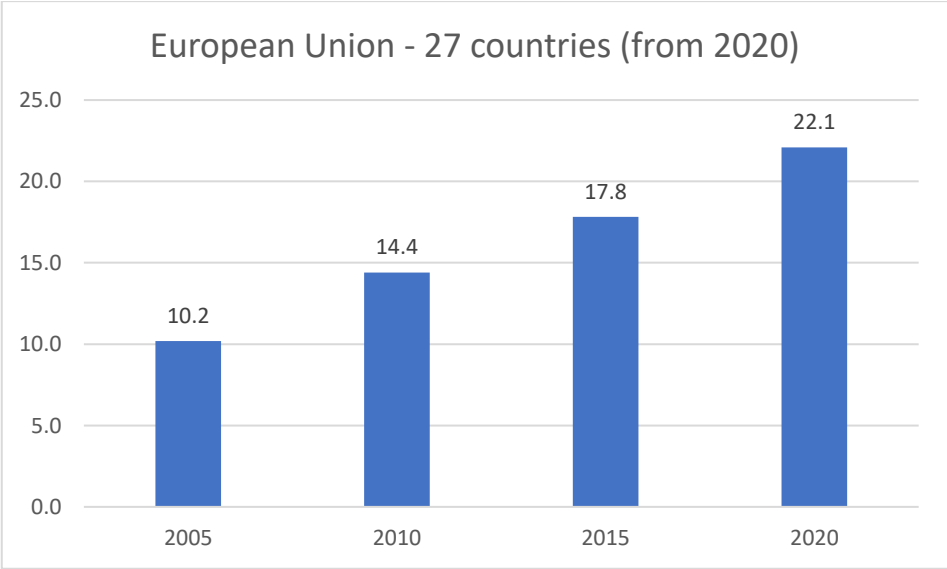


Figure 4.7: Share of Energy from Renewable Sources
Source: Eurostat (nrg_ind_ren), 2022

Eurostat divides the usage of renewables into three sectors. These are the transportation, creation of electricity and finally, usage for heating and cooling.[207] Deeper look on each factor shows that while this trend portrays a commendable initiative, it is not consistent across the domains of utilisation. Indeed, the role of renewables is more prevalent in electricity generation, reaching 37.5% in that sector while the usage of renewables in transportation is visibly behind with only covering the 10.2% of share in the domain (see figure 4.8).[208]

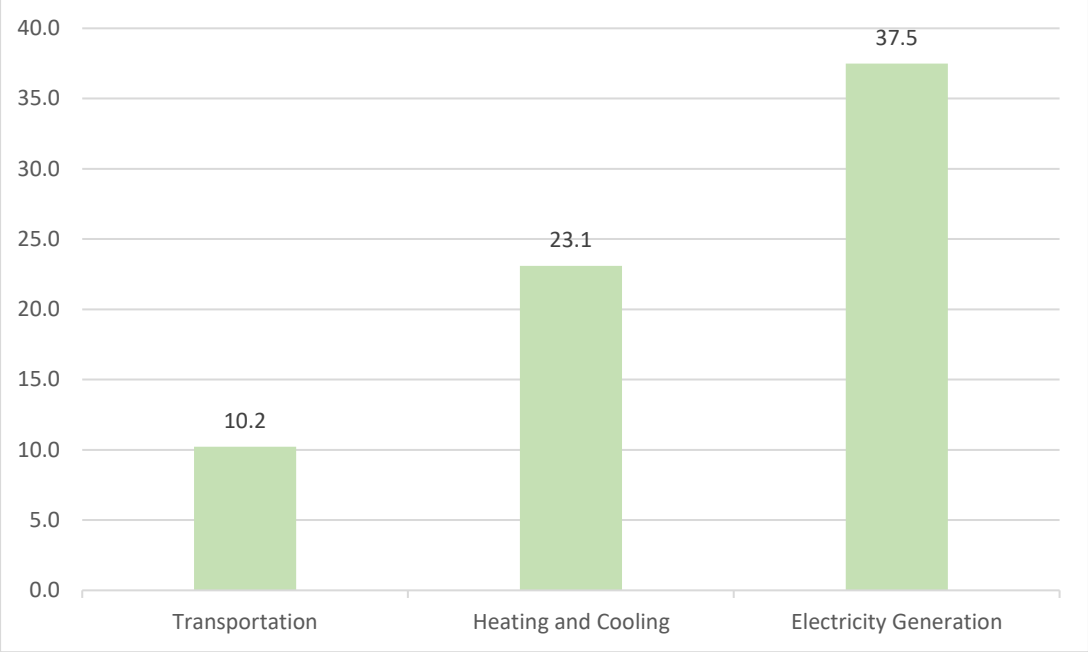


Figure 4.8: Share of Renewable Sources Across the Sectors (%) in 2020
Source: Eurostat (nrg_ind_ren), 2022

The journey of the European Union in relation to climate change and renewables can be traced back to the United Nations Framework Convention on

[207] Eurostat. 'Renewable Energy Statistics'. Eurostat, 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics#Share_of_renewable_energy_more_than_doubled_between_2004_and_2020.

[208] Eurostat. 'Share of Energy from Renewable Sources (NRG_IND_REN)', 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_REN__custom_3578192/default/table?lang=en.

Climate Change in 1992.[209] This convention aimed to stabilise the greenhouse gas concentration to prevent the rapid deterioration of the climate system.[210] Following the Kyoto Protocol in 1997, the European Union passed a 2020 Climate & Energy Package in 2009.[211] The goals of the package were delegated into three binding directives, one of which was Directive 2009/28/EC.[212] Under this directive, the European Union were to achieve a 20% change in three main areas. These were the 20% reduction in emissions, a 20% increase in energy efficiency, and finally, the goal of 20% energy coming from renewable sources.[213] Moreover, the EU's green journey continued and in 2014 the leaders of the member states agreed on a climate and energy policy framework for 2030.[214] This framework, -created during Junker's presidency (2014-2019)- envisioned EU-level binding targets for a 40% reduction of countries' emission rates by 2030 from their 1990 level; a minimum objective of 27% share of renewable energy in the energy consumption with a 27% increase in energy efficiency from their 1990 baseline. In 2018, Directive (EU) 2018/2001 repealed the Directive 2009/28/EC and set the new minimum share of renewables to 32% of the energy production.[215]

---

[209] UN Climate Change Secretariat. 'Status of Ratification of the Convention'. United Nations Framework Convention on Climate Change Secretariat, n.d. Accessed October 19, 2022. Available from: https://unfccc.int/process-and-meetings/the-convention/status-of-ratification-of-the-convention.

[210] ibid. Article 2-Objective

[211] European Commission. '2020 Climate & Energy Package'. European Commission. Accessed 13 October 2020. https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2020-climate-energy-package_en.

[212] Directive 2009/28/EC of the European Parliament and of the Council (OJ L 140, 5.6.2009, p. 16)

[213] London School of Economics and Political Science. '2020 Climate and Energy Package'. Grantham Research Institute on Climate Change and the Environment and Sabin Center for Climate Change Law, n.d. Accessed October 19, 2022. Available from: https://climate-laws.org/geographies/european-union/laws/2020-climate-and-energy-package-contains-directive-2009-29-ec-directive-2009-28-ec-directive-2009-31-ec-and-decision-no-406-2009-ec-of-the-parliament-and-the-council-see-below.

[214] Bolado, Laura. '2030 Climate and Energy Framework - Snapshot'. RELX Sustainable Development Goals Resource Centre, 2019. Accessed October 19, 2022. Available from: https://sdgresources.relx.com/legal-practical-guidance/2030-climate-and-energy-framework-snapshot.

[215] 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 (recast) (Text with EEA relevance.) PE/48/2018/REV/1 OJ L 328, 21.12.2018, p. 82–209

Closer to today, a proposal for a directive aiming to amend the Directive (EU) 2018/2001 was adopted by the European Commission on 15 July 2021.[216] According to the proposal, the carbon neutrality by 2050 and a 55% reduction of emission by 2030 goals of the European Green Deal requires a change in legislation. The proposal reasoned that the binding goal of 32% energy coming from the renewables set by the aforementioned directive is not suitable for EU to carry out and become carbon neutral by 2050. In the proposal, the text proposed by the Commission show that the Commission aimed to increase this rate to 40% by 2030.[217]

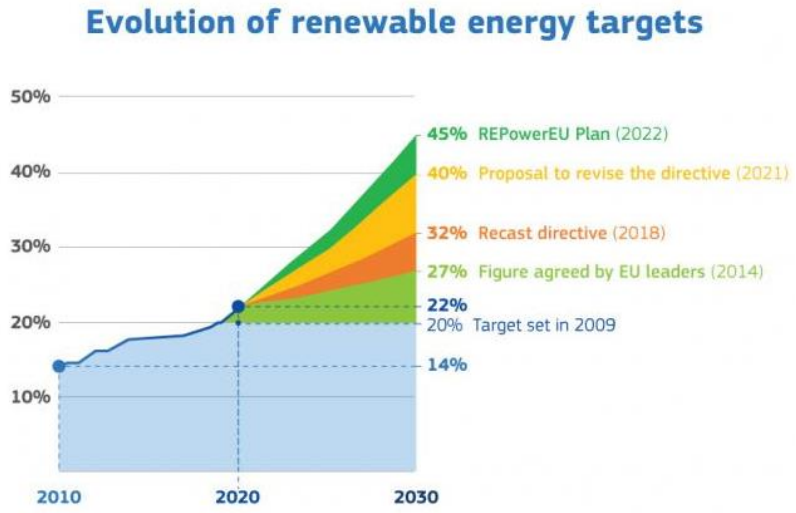


Figure 4.9: Share of Renewable Sources Across the Sectors (2020)
Source: European Commission, n.d.

This goal, which was one of objectives of the Fit for 55 package of the EU,[218] received changes following the Russian invasion of Ukraine. The more recent

[216] Proposal for a Directive of the European Parliament and of the Council amending Directive (EU) 2018/2001 of the European Parliament and of the Council, Regulation (EU) 2018/1999 of the European Parliament and of the Council and Directive 98/70/EC of the European Parliament and of the Council as regards the promotion of energy from renewable sources, and repealing Council Directive (EU) 2015/652

[217] Bentele, Hildegard. 'Opinion of the Committee on Development for the Committee on Industry, Research and Energy', 2022. p. 5 Accessed November 5, 2022. https://www.europarl.europa.eu/doceo/document/DEVE-AD-719604_EN.pdf.

[218] Council of the European Union. '"Fit for 55": Council Agrees on Higher Targets for Renewables and Energy Efficiency'. *Council of the European Union*, 27 June 2022. Accessed October 19, 2022. Available from: https://www.consilium.europa.eu/en/press/press-releases/2022/06/27/fit-for-55-council-agrees-on-higher-targets-for-renewables-and-energy-efficiency/.

REPowerEU plan, as examined in chapter 3.2.2.4., has not only brought the reduction of Russian natural gas imports into the agenda but also indicated a further increase of renewables in the energy mix. Indeed, the REPowerEU plan seeks to make the renewables to reach 45% of the total energy consumption of the EU by 2030.[219]

4.3.1 Role of Natural Gas

The role of the natural gas in the framework of these green initatives of the EU will require special attention in order to understand the future of the resource. In this regard, this research will briefly discuss two specific natural gas related issues. The first one is the "taxonomy" regulation that the EU uses to pivot the future investments in energy field, and the second one being production of methane via biogas.

Regarding the first aspect, the Regulation (EU) 2020/852[220] adopted on 22 June 2020, also known as the "taxonomy" regulation, has set out an action plan for sustainable growth in the European Union. According to the summary of the document in EUR-Lex, the regulation targets to redirect capital towards sustainable investments while mitigating financial risks occurring from climate change, environmental decay, disasters and social problems.[221] In order to achieve these targets, the regulation subjects the economic activity to conform to its guidelines to deem it environmentally sustainable. The regulation lists six objectives as goals to protect the environment and scrutinizes whether an economic activity is harmful to the set goals or not.[222] While

[219] European Commission. 'REPowerEU: Affordable, Secure and Sustainable Energy for Europe'. European Commission, 2022. Section Clean Energy Accessed October 19, 2022. Available from: https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en.

[220] European Commission. 'EU Taxonomy for Sustainable Activities What the EU Is Doing to Create an EU-Wide Classification System for Sustainable Activities.', n.d. Accessed October 19, 2022. https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en.

[221] EUR-Lex. 'Assessing Environmentally Sustainable Investments'. EUR-Lex. Accessed 14 October 2022. https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=celex:32020R0852.;
Regulation (EU) 2020/852. *on the establishment of a framework to facilitate sustainable investment, and amending Regulation (EU) 2019/2088*. European Parliament, Council of the European Union

[222] EUR-Lex. 'Assessing Environmentally Sustainable Investments'. EUR-Lex. Accessed 14 October 2022. Environmental objectives and Criteria Available from: https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=celex:32020R0852.

the Article 10 and the Article 19 of the regulation, which set out the definition of substantial contribution to climate change mitigation and the conditions of the technical screening criteria respectively, specifically mention the solid fossil fuels and deem them not compatible with the criteria; the regulation does not include natural gas or the role it can have.[223] This put natural gas in a unique spot along with nuclear power since they are not in solid fossil fuel category and were not directly targeted by the EU taxonomy regulation. The position of the EU on natural gas was further clarified on 2 February 2022, when a draft included gas and nuclear energy as a complementary to the taxonomy regulation, which was approved in principle by the European Commission.[224] This draft specifies that the gas and nuclear-related energy activities will take part in the EU's taxonomy regulation under certain circumstances. According to the factsheet, the activity range of gas includes electricity generation, combined generation of heat and power, production of heating/cooling by the districts.[225] The European Commission adopted the draft under the Commission Delegated Regulation (EU) 2022/1214 on 9 March.[226] On 27 June 2022, a motion in the European Parliament objected to this delegated act citing that the usage of gas and nuclear activities may cause significant socio-economic and environmental repercussions.[227] This motion for a resolution (B9-0338/2022) was rejected by the European Parliament on 6 July by 328 votes in against versus 278 votes in favour, showing that the European Parliament

[223] Regulation (EU) 2020/852.

[224] European Commission. 'EU Taxonomy: Complementary Climate Delegated Act to Accelerate Decarbonisation'. *European Commission*, 2 February 2022. Accessed October 19, 2022. Available from: https://finance.ec.europa.eu/publications/eu-taxonomy-complementary-climate-delegated-act-accelerate-decarbonisation_en.

[225] European Commission. 'Complementary Climate Delegated Act on Certain Nuclear and Gas Activities', 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/sustainable-finance-taxonomy-complementary-climate-delegated-act-factsheet_en.pdf.

[226] Commission Delegated Regulation (EU) 2022/1214 of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in certain energy sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities (Text with EEA relevance) C/2022/631 OJ L 188, 15.7.2022, p. 1–45.

[227] European Parliament. 2022. MOTION FOR A RESOLUTION on the Commission delegated regulation of 9 March 2022 amending Delegated Regulation (EU) 2021/2139 as regards economic activities in certain energy sectors and Delegated Regulation (EU) 2021/2178 as regards specific public disclosures for those economic activities. Retrieved from https://www.europarl.europa.eu/doceo/document/B-9-2022-_0338_EN.html.

was not against including natural gas and nuclear in the EU's taxonomy regulation. Thus, the regulation in question was published in the Official Journal on 15/07/2022 and currently is in force.

In general, while the taxonomy regulation does not necessarily ban activities that are outside of its scope or failing to achieve the criterion, it acts as a transparent framework for future investments.[228] Indeed, Pacces believes that, even with an unknown pace, the established framework will lead investors pushing the corporate actors to more green practices.[229]

This second issue of the chapter will be the "green" ways to obtain methane to cover the renewable options for producing the main component of natural gas. Recall from Chapter 2. that methane is the main component of natural gas. The IEA uses two distinct classifications for natural ways to create methane. The first one, biogas, is created when an organic matter decomposes in an oxygenless environment.[230] The result of this process, which can be achieved via various methods, produces methane, CO_2 and other trace amounts of gasses. The contents of biogas vary depending on the production method and the sources it is produced from. Furthermore, the methane composition in the biogas may range from 45% to 75% of the overall volume, hence, leading to differing results in the energy potency of biogas.[231]

The second way to produce methane, which is called biomethane, is achieved either by removing any residual gasses in the biogas, essentially "upgrading" it, or by heating up solid biomasses in a low-oxygen and high-pressure environment.[232] The

---

[228] Abnett, Kate, and Simon Jessop. 'Explainer: What Is the EU's Sustainable Finance Taxonomy?' *Reuters*, 6 July 2022. Accessed October 19, 2022. Available from: https://www.reuters.com/business/sustainable-business/what-is-eus-sustainable-finance-taxonomy-2022-02-03/.

[229] Pacces, Alessio M. 'Will the EU Taxonomy Regulation Foster Sustainable Corporate Governance?' *Sustainability* 13, no. 21 (8 November 2021): 12316. p. 18. Accessed October 19, 2022. Available from: https://doi.org/10.3390/su132112316.

[230] IEA. 'Outlook for Biogas and Prospects for Organic Growth'. *World Energy Outlook Special Report*, 2020. p. 13. Accessed October 19, 2022. Available from: https://iea.blob.core.windows.net/assets/03aeb10c-c38c-4d10-bcec-de92e9ab815f/Outlook_for_biogas_and_biomethane.pdf.

[231] ibid.

[232] ibid.

cleansing of biogas method currently accounts for 90% of biomethane production around the world.[233]

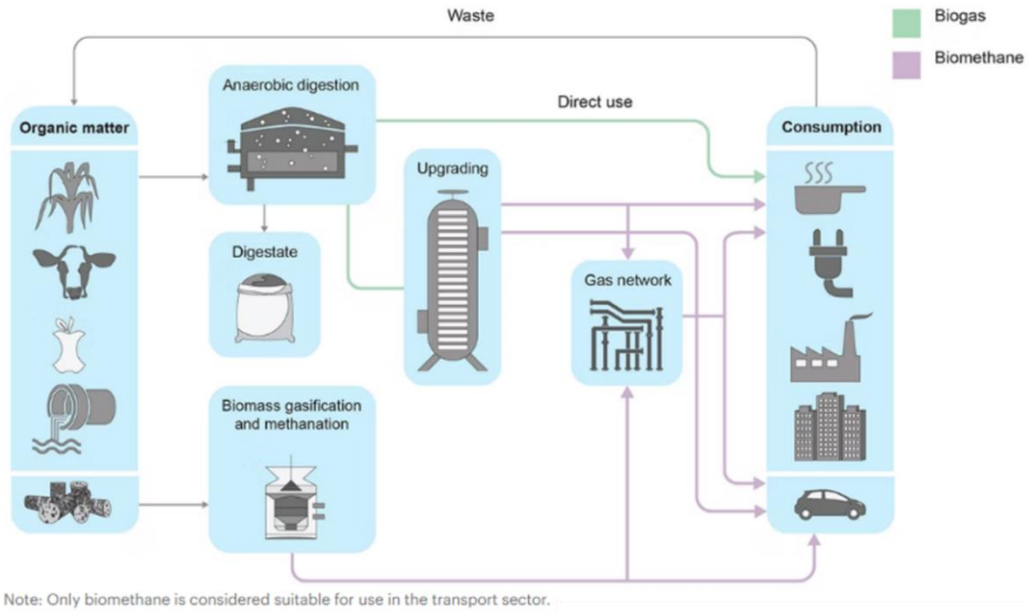


Figure 4.10: Biogas and Biomethane Chain
Source: EIA, 2020

Going back to the European Union, the REPowerEU strategy also includes an objective to increase biomethane production.[234] Since the usage of biomethane is indistinguishable from natural gas due to its applicability in any natural gas infrastructure and its power and heating value,[235] this research will also delve more into the REPowerEU plan. As mentioned in the previous subsection, the Fit For 55 project was revisited via the REPowerEU plan and the goal of 17 bcm worth of biomethane production by 2030 was upgraded to reach 35bcm.[236] For the current

[233] ibid.

[234] Communication from the Commission to the European Council and the European Parliament, REPowerEU: Joint European Action for more affordable, secure and sustainable energy COM/2022/108 final

[235] IEA. 'Outlook for Biogas and Prospects for Organic Growth'. *World Energy Outlook Special Report*, 2020. p. 13 Available from: https://iea.blob.core.windows.net/assets/03aeb10c-c38c-4d10-bcec-de92e9ab815f/Outlook_for_biogas_and_biomethane.pdf.

[236] Communication from the Commission to the European Council and the European Parliament, REPowerEU: Joint European Action for more affordable, secure and sustainable energy

situation, the Gas for Climate -which is a group made out of eleven gas transport companies and three renewable gas industry associations in Europe- gives 3bcm of biomethane production and 17 bcm worth of biogas production as the EU's current capability as of March 8, 2022.[237]

4.4. Evaluation of the Dependency

With the major components regarding the natural gas domain completed, the research will now attempt to evaluate the EU's ability to reduce its natural gas dependency on Russia. For a general summary, first recall that the Regulation (EU) 2022/1032 (in force), is a binding piece of legislation that will make the member states have their natural gas stockpiles filled up to 80% for this year and up to 90% for 2023 and onwards (Chapter 3.2.2.4).[238] Similarly, the recently amended Regulation (EU) 2017/1938 acts as a safety net for the member states with no capacity to store natural gas on their own to be able to use other member states' storage to protect their energy security (Chapter 3.2.1. and 3.2.2.4). These two factors will be the foundation of the assessment period due to their binding characteristic and their relation with natural gas. The inclusion of natural gas in the EU's taxonomy also shows that the demand of natural gas does not seem to be replaced anytime soon. This is further supported with set goals of the REPowerEU, which aims to reduce the EU's gas demand by 2030.

On the issue of the evaluation, this research will also mention the objectives of the REPowerEU since it presents both a short-term vision, which is by the end of 2022, and a long-term vision for 2030. This addition is also in line with this research since the priority of the REPowerEU plan is to reduce the dependency on Russian imports. For more information of the subject, the estimated goals for the reduction of gas in REPowerEU are listed in the table below.

COM/2022/108 final

[237] Gas for Climate. 'Commission Announces Groundbreaking Biomethane Target: "REPowerEU to Cut Dependence on Russian Gas"'. *Gas for Climate*, 8 March 2022. Accessed October 19, 2022. https://gasforclimate2050.eu/news-item/commission-announces-groundbreaking-biomethane-target-repowereu-to-cut-dependence-on-russian-gas/.

[238] Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) No 715/2009 with regard to gas storage (Text with EEA relevance) *OJ L 173, 30.6.2022, p. 17–33*

Table 4.2: REPowerEU Short and Long Term Ambitions

REPowerEU Ambitions	Short-term (by the end on 2022)	Long-term (by 2030) Total
Gas Diversification (LNG)	50 bcm	50 bcm
Gas Diversification (Pipeline)	10 bcm	10 bcm
More Renewable Gas (Biomethane)	3.5 bcm	35 bcm
More Renewable Gas (Hydrogen)	-	32-66 bcm
Energy Efficiency (Homes)	18 bcm	48 bcm
Changes in Power Sector (Wind and Solar)	20 bcm	Frontloaded
Transformation of Industry (Electric-Hydrogen)	Frontloaded	Frontloaded

Source: European Commission

As seen from table 4.2, the immediate reduction in natural gas, if we exclude the diversification, is at 41.5 bcm. This reduction averages somewhere between 115 to 149 bcm by 2030.

Returning to the evaluation process, this research will use the following formula as its main component:

$$EU\ Gross\ Inland\ Consumption + Storage\ requirements - (Domestic\ Production + Pipeline\ Import\ Capacity + LNG\ Import\ Capacity)$$

As each of these components were already covered in detail by the research, it can be adapted for future use if necessary. Furthermore, since this research has covered only the non-Russian pipeline capacities, should the result of the previous formula remain above the zero, then the remainder must be fulfilled via Russian gas imports. As for the details of each component, the following are given:

The European Commission mentions 400 bcm as the natural gas demand of the EU.[239] This information is using the gross inland consumption since the 400 bcm average demand shows consistency with the Eurostat database for the years prior to 2021.[240] Thus, the evaluation will use the 400 bcm as the basis for the EU's total natural gas demand.

The total underground storage capacity of the EU, which needs to be filled up to 80% by the end of this year, is around 100 bcm.[241] As of 13/10/2022, the EU has stocked up to around 90% of its storage capacity (see Figure 4.11). Therefore, this research will start from the 58% position of the storage capacity[242] and aim to reach for 90% in order to simulate the entry of the Regulation (EU) 2022/1032 in force on June 30th.

As of 15/10/2022, The latest annual information on production, states that the EU's production has decreased by 7.6% in 2021.[243] According to Eurostat monthly figures, the total for the year 2021 is estimated as 50.5 bcm.[244] According to the same

---

[239] European Commission. 'Liquefied Natural Gas'. European Commission. Accessed 10 October 2022. Consumption and Demand https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en.

[240] Eurostat. 'Supply, Transformation and Consumption of Gas (NRG_CB_GAS)'. Eurostat, n.d. Accessed November 5, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_3594043/default/line?lang=en.

[241] European Commission. 'Questions and Answers on the New EU Rules on Gas Storage'. European Commission, 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_1937.

[242] Regulation (EU) 2022/1032 of the European Parliament and of the Council of 29 June 2022 amending Regulations (EU) 2017/1938 and (EC) No 715/2009 with regard to gas storage (Text with EEA relevance) *OJ L 173, 30.6.2022, p. 17–33*

[243] European Commission. 'Natural Gas Supply Statistics'. European Commission, 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Natural_gas_supply_statistics#Supply_structure.

[244] Eurostat. 'Supply, Transformation and Consumption of Gas - Monthly Data [NRG_CB_GASM__custom_3594950]'. Eurostat, 2022. Accessed November 5, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GASM__custom_3594950/default/table?lan%09g=en.

database report, there is a 10% decrease in 2022 monthly figures (Jan-Jul total comparison). Thus, 45.45 bcm. will be assesed as the 2022 total production.

On the issue of non-Russian pipelines, the gross pipeline capacity in Northern Route is found 89.8 bcm.[245] This figure can theoretically go 10 bcm. more with the addition of Baltic Line.[246] Furthermore, in 2020, Norway's net excess was 109.9 bcm[247], hence, the country is capable of supplying the EU with pipelines and LNG. The UK can also import LNG and transfer it via its connections to the EU. In that case, this route's potential can reach up to 130.8 bcm. The gross gas export capacity in Southern Route reaches 66.5 bcm if the maximum capacity of the pipelines from Algeria[248] and Libya[249] is fully utilized. Lastly, the Eastern Route's maximum potential currently stands at 10 bcm in 2022.[250]

The operational large-scale LNG import capacity of the EU27 countries in April 2022 stood at 160bcm/y with an additional 7 bcm/y infrastructure built but not operational in Spain.[251] Thus the calculation will take 160 bcm. as the EU's LNG import capacity.

[245] Chapter 3.1.4. "Northern Route" section.

[246] Chapter 4.2. "Baltic Pipeline Project"

[247] Eurostat 2020 figure (nrg_cb_gas)

[248] Algeria exported 54.7 bcm of natural gas in 2021. OPEC. 'Algeria Facts and Figures'. OPEC, 2022. Accessed October 19, 2022. Available from: https://www.opec.org/opec_web/en/about_us/146.htm.

[249] Libya exported 8 bcm of natural gas in 2021. OPEC. 'Libya Facts and Figures'. OPEC, 2022. Accessed October 19, 2022. Available from: https://www.opec.org/opec_web/en/about_us/166.htm.

[250] Trans Adriatic Pipeline. 'How TAP Operates'. Trans Adriatic Pipeline. Accessed 15 October 2022. https://www.tap-ag.com/infrastructure-operation/how-tap-operates.

[251] Gas Infrastructure Europe. 2022. "LNG Map (April 2022)." Accessed October 19, 2022. Available from: https://www.gie.eu/publications/maps/gie-lng-map/.

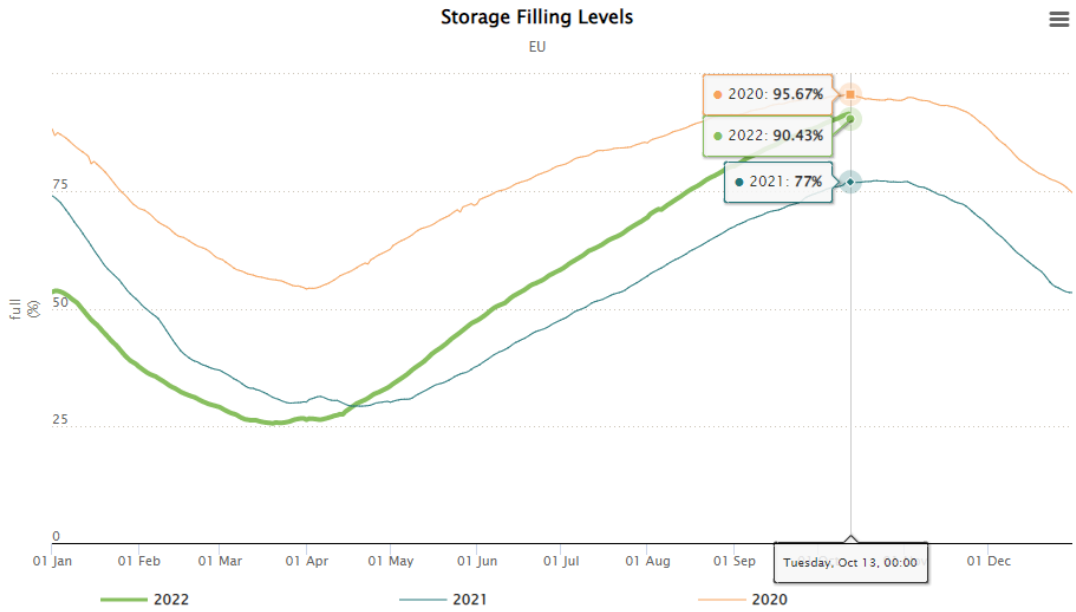


Figure 4.11: Natural Gas Storage Levels 2020-2022
Source: Gas Infrastructure Europe, 2022

The theoretical evaluation for the year 2022 shows that the aforementioned import capacities of the EU can satisfy 336.3 bcm of imports (Pipelines + LNG). This capacity can reach up to 367.3 should the UK also directs its pipeline capacity towards Europe. However, the net demand of 354.55 bcm. (400bcm. – 45.45bcm.), when coupled with the remainder of storage requirement of 32 bcm. reaches up to 386.55 bcm. for 2022. Thus, the EU is not in a position to fully reduce its natural gas dependency due the remainder of the 50 bcm. still needs to be covered by Russian imports.

Nevertheless, this situation reduces the dependency on Russian imports (155bcm.)[252] nearly by two thirds. The data acquired from the Eurostat monthly calculations show that Russia has supplied the EU with 46.4 bcm. since the beginning

[252] European Commission. 'In Focus: Reducing the EU's Dependence on Imported Fossil Fuels'. European Commission, 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/info/news/focus-reducing-eus-dependence-imported-fossil-fuels-2022-apr-20_en.;

Boehm, Lasse, and Alex Wilson. 'EU Gas Storage and LNG Capacity as Responses to the War in Ukraine', 2022. p. 2. Accessed October 19, 2022. Available from: https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/729401/EPRS_BRI(2022)729401_EN.pdf.

of the 2022 (from January until July).[253] This situation further is in line with the estimation. Furthermore, The EU can further reduce the remainder demand on Russian gas with the reductions foreseen by the REPowerEU and/or by using coal as a substitute for natural gas in electricity mix. Indeed, should the need arises, it is theoretically possible for Germany and Poland to fully replace the natural gas with coal in electricity sector.[254] While this is contradicting with the environmental goals of the EU, several cases of transition have been reported.[255]

On the issue of electricity generation, when the years 2019 and 2020 are examined, the share of natural gas in was found to be around twenty percent.[256] However, according to the latest available data from Eurostat (2020 data), a complete

[253] Eurostat. 'Imports of Natural Gas by Partner Country - Monthly Data (NRG_TI_GASM)', 2022. Accessed November 5, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GASM__custom_3595752/default/table?lang=en.

[254] Hieminga, Gerben, Nadège Tillier, and Leszek Kasek. 'Back to Black: The Countries Best Positioned to Replace Russian Gas with Coal'. *ING*, 27 June 2022. p. 3. Accessed October 19, 2022. Available from: https://think.ing.com/articles/the-countries-best-positioned-to-replace-russian-gas-with-coal.

[255] Eckert, Vera, and Francesca Landini. 'Europe May Shift Back to Coal as Russia Turns down Gas Flows'. *Reuters*, 20 June 2022. Accessed October 19, 2022. Available from: https://www.reuters.com/world/europe/europe-may-shift-back-coal-russia-turns-down-gas-flows-2022-06-20/.;

Frost, Rosie. 'All the European Countries Returning to "Dirty" Coal as Russia Threatens to Turn off the Gas Tap'. *Euronews*, 24 June 2022. Accessed October 19, 2022. Available from: https://www.euronews.com/green/2022/06/24/all-the-european-countries-returning-to-dirty-coal-as-russia-threatens-to-turn-off-the-gas.;

Kinkartz, Sabine. 'Germany's Energy U-Turn: Coal Instead of Gas'. *DW*, 4 August 2022. Accessed October 19, 2022. Available from: https://www.dw.com/en/germanys-energy-u-turn-coal-instead-of-gas/a-62709160.;

'Despite Climate Commitments, the EU Is Going Back to Coal'. *Le Monde*, 2 September 2022. Accessed October 19, 2022. Available from: https://www.lemonde.fr/en/economy/article/2022/09/02/despite-climate-commitments-the-eu-is-going-back-to-coal_5995594_19.html.;

Romei, Valentina, and Martin Arnold. 'Germany Turns to Coal for a Third of Its Electricity'. *Financial Times*. 7 September 2022. Accessed October 19, 2022. Available from: https://www.ft.com/content/9d3c8af8-ae00-4dc5-9e85-579681450c9c.

[256] Eurostat. 'Complete Energy Balances Data'. Eurostat, n.d. Pie chart in "Gross electricity production" Accessed November 3, 2022. Available from: https://ec.europa.eu/eurostat/cache/infographs/energy_balances/enbal.html.

switch to alternatives (coal and or nuclear) in electricity, in theory, can only result in 14.73% reduction in total natural gas demand.[257] While not all countries possess the necessary infrastructure for such change, this potential roughly corresponds to 58.92 bcm. reduction in total gas demand.

Therefore we see that, while the role of natural gas in electricity generation is important, the total consumption of the resource for other purposes is more significant.

For the year 2022, the decrease in Russian imports also play an important role. Gas coming from the Nordstream Pipeline, which has a 55 bcm. annual capacity and directly connects Russia with Germany, has been subject to interruption on various cases. According to BBC, the pipeline operated at 25% capacity -40 (out of 170) million cubic metres daily- in the month of June; and after a 10 day-long maintenance in July, only sent 20 million cubic metres to Germany until completely shutting down in August.[258] This reduction is also evident in the weekly data compiled by the Brugel where Russia is well below the minimum rate that was examined between the years 2015-2020 (see Figure 4.12).[259]

[257] Eurostat. 'Complete Energy Balances (NRG_BAL_C)', 2022. Accessed October 19, 2022. Available from: https://ec.europa.eu/eurostat/databrowser/bookmark/2ae30e16-3346-45bd-9217-0334b080dc17?lang=en.

[258] 'Nord Stream 1: How Russia Is Cutting Gas Supplies to Europe'. *BBC*, 29 September 2022. Accessed October 19, 2022. Available from: https://www.bbc.com/news/world-europe-60131520.

[259] Zachmann, Georg, Giovanni Sgaravatti, and Ben McWilliams. 'European Natural Gas Imports', 2022. Accessed October 19, 2022. Available from: https://www.bruegel.org/dataset/european-natural-gas-imports.

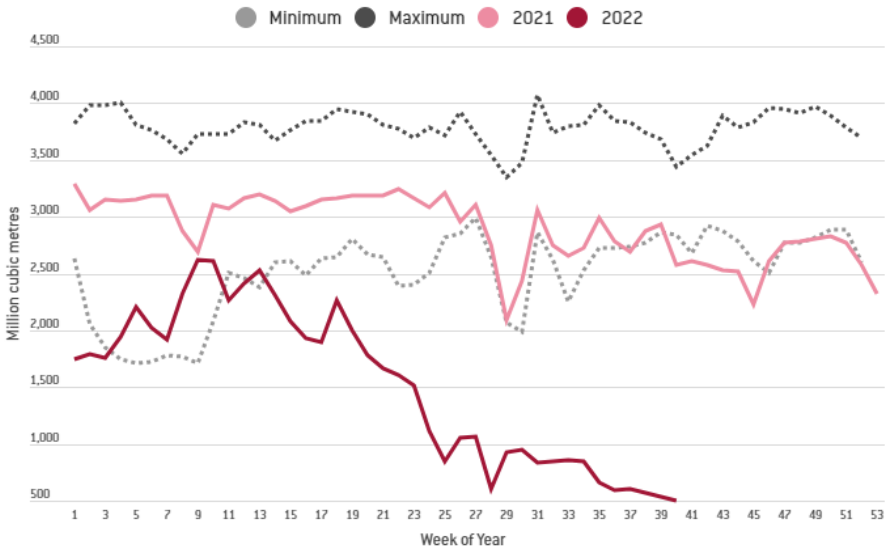


Figure 4.12: EU+UK Natural Gas Imports from Russia
Source: Bruegel, 2022

On the issue of reductions, which will help in reducing Russian dependency, several aspects needs to be discussed.

Looking back with hindsight in 2022, the European Union has managed to achieve its 2020 energy generation goal from the renewables. The long-term goals of the REPowerEU aim for a 115 to 149 bcm total reduction in demand by 2030. These factors, regardless of diminishing domestic production of natural gas, when coupled with increased LNG capabilities in both EU's own soil and other exporting countries, can change the picture drastically. Furthermore, any expansion of the potential pipelines whether they are upgraded, such as the TAP-TANAP network, or newly built, cases as Trans-Caspian or Trans-Saharan, will have a significant impact on the diversification portfolio of the European Union.

On the price of LNG imports, regardless of whether they are coming from spot trade or not, will be on the higher side than the pipeline imports as discussed in earlier chapters. This situation inadvertently will have negative repercussions on the EU's economy, but it also might be what the US domestic production needs to keep going. As the two actors share similar viewpoints on the geopolitical realm, further cooperation in the field of energy especially in the natural gas sector, is a strong possibility.

The idea of utilizing coal as an electricity source for a limited stop-gap measure is a possibility. However, as discussed in Chapter 3, this does not completely eliminate the European Union's need for natural gas. Furthermore, significant reliance on coal for such endevour will ultimately go against the environmental objectives of the Union as it is a more polluting resource (see Chapter 2).

The nuclear case also suffers from the same issue since only a small fraction is used outside of electricity generation.[260] Thus, it can only compete with the coal sector in reducing the electricity demand from natural gas.

4.5. Conclusion

Since this research has attempted to pursue a grand coverage for the natural gas domain and its consumption, it employed the gross inland consumption figures to generalise domestic usage. Nevertheless, a detailed look at the consumption fields is possible.[261] These fields are grouped into 5 categories to provide a more definitive picture.

The examination of the Eurostat database indicates that natural gas is primarily used for heating (see Figure 4.13). 2020 figures show that the European Union spent 57% of its natural gas to heat its industries, households, agriculture/forestry, and service sectors.

The second main usage of natural gas is electricity and heat generation. While electricity generation alone could only cover 14% of the natural gas consumption, simultaneous electricity and heat generation (which is a separate branch) constituted another 16% of the consumption. Finally, heat generation alone is only responsible for 2% of the total consumption, thus, the combined usage of natural gas in electricity and heat generation covers 33% of the gross inland consumption.

---

[260] Eurostat. 'Nuclear Energy Statistics'. Eurostat, 2022. Available from: https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Nuclear_energy_statistics#Nuclear_heat_and_gross_electricity_production.

[261] Eurostat. 'Energy Balance Flow for EU27_2020 2020'. Eurostat, 2022. Available from: https://ec.europa.eu/eurostat/cache/sankey/energy/sankey.html?geos=EU27_2020&year=2020&unit=KTOE&fuels=TOTAL&highlight=_2_&nodeDisagg=1111111111111&flowDisagg=true&translateX=-4230.977341397222&translateY=-577.8082089591157&scale=3&language=EN

The third main field for natural gas usage is confusingly located in the energy branch consumption. Any usage in this field is defined as the consumption of resources with the purpose of enabling energy transformation and production. For natural gas, heating of LNG back to its original state and natural gas extraction sites using natural gas to power themselves are located in this section. Perhaps surprisingly, the transformation in the oil refineries covers more than half of this part. Overall, this field constituted 5% of the gross inland consumption of natural gas in the EU.

The fourth most usage covers the non-energy consumption of natural gas with 4%. As explained at the beginning of Chapter 3, this field constitutes usage other than heat/energy purposes and mainly for the creation of products such as fertilizers and plastics.

The final usage refers to the consumption in transportation. Covering only 1% of the gross inland consumption for natural gas, pipelines using natural gas to power their pumps (as explained in Chapter 2.3.2) or road vehicles using natural gas to move are located in this field.

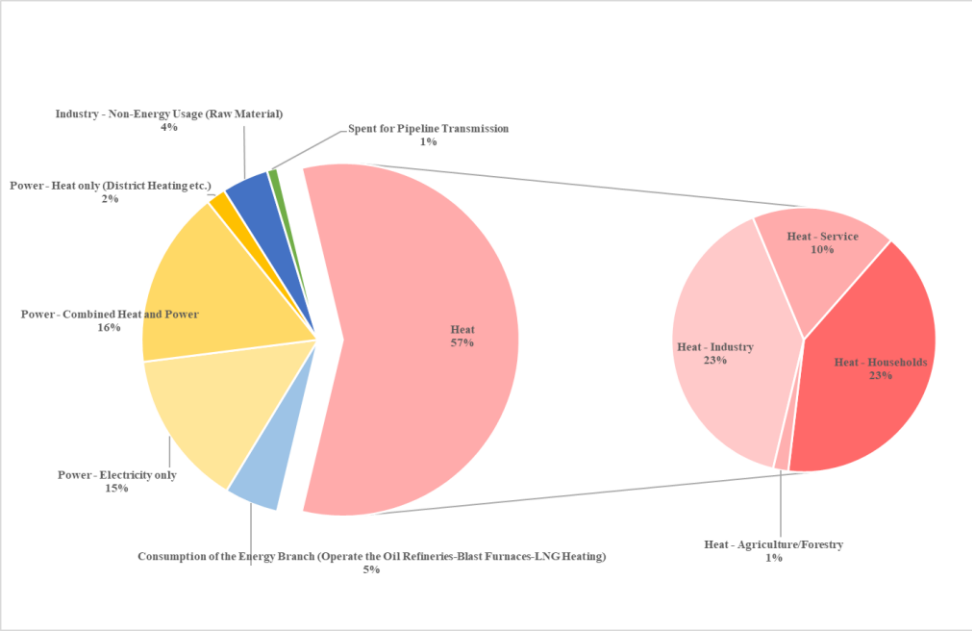


Figure 4.13: EU Natural Gas Balance Flow in 2020
Source: Eurostat

This detailed look at consumption fields shows that natural gas as a heating resource may not be compatible to be substituted via other fuel sources at least in the short duration. Indeed any change on the issue may require a significant restructuring

of the heating systems not just in the service and industry sectors but also for households as well. Furthermore, as explained in the evaluation of the dependency section, net electricity substitution with green or other fuel types can only reduce around 15% of the total demand. The combined power and heat generation, on the other hand, will also be subject to significant restructuring if they are also included for such action.

Any domestic alternative, whether more extraction (covered in Chapter 3.1.) or biomethane production (covered in Chapter 4.3.1.) can not mitigate the sudden reduction of Russian gas by itself. This is especially evident in biomethane production which when combined with biogas can only reach 20bcm. at the beginning of the year.

Furthermore, new pipeline projects also suffer from the same issue due to the lengthy time it will take to establish the necessary infrastructure to provide natural gas to the continent. This challenge is further exacerbated when we consider the potential candidates for such an endeavour. First, any extension from the southern route will require pipelines crossing more than 4,000 kilometres of land to bring new gas. Moreover, the capacity of the planned Trans-Saharan pipeline will also require an additional 5 bcm. infrastructure to enter the Union without bottlenecking Algeria's exports. Secondly, political considerations may also hinder these significant projects as well. This can be seen in the eastern route where Turkmenistan can be constrained to not act as freely due to the potential pressure from Russia. It is also important to point out that the potential sabotage and the subsequent damages to Nord Stream and Nord Stream 2 may also occur in the undersea installations coming from the northern route as well.

This leaves further LNG imports as the primary alternative to reduce dependency on Russian imports. As covered in chapters 3.1.3. and 4.1., the European Union did not utilise its LNG capacity to its fullest and still has wiggle room to do so. During the research process, an increase in LNG shipments supplying the EU and new facilities being fast-tracked to be built were also observed which consequently provide the evidence for EU's preference in this regard. This preference while leading to a more expensive way to reduce dependence, it creates the highest freedom for the EU when it comes to the suppliers. Since the European Union is the second largest consumer of natural gas, the calculations and actions it will take on this trade-off, along

with the entailing ecologic and political luggage, will inevitably shape the natural gas domain in the future.

CHAPTER 5

CONCLUSION

As the continuous changes in information regarding natural gas, along with the sudden nature of political developments, makes it difficult to precisely illustrate the topic, to remain usable in future applications, this research has covered the necessary components in one place and given explanations of each item. Thus, it can help not only in clearing the complicated terminologies and their use, but also references plenty of official databases that cover the issue. Undoubtedly, it is difficult to describe the subject in a holistic way when even the calculations for natural gas are subject to different interpretations. Yet, this research has endeavoured to do so.

The overall requirement for future usability necessitated significant coverage, therefore, each chapter has its own conclusion to summarise the noteworthy findings of this research. Accordingly, the research itself has opted to use this formula via using the 2019 figures initially to explain the across-the-board circumstances covering the natural gas domain in isolation due to the significant consequences of events such as the COVID-19 Pandemic and the Russian invasion of Ukraine. This research, however, did not extend itself to include the Energy Community, throughout which the European Union multiplied a framework in energy fields -including natural gas- in order to promote an environment of cooperation and alternative solutions with non-EU states that are located in Black Sea and South East Europe.[262]

Granted, these findings will certainly change with time as was the case for the year 2022. This argument especially holds true for the case of recent Saudi-Russian rapprochement in OPEC+, where the research indicated a potential schism previously.

---

[262] Tangör, Burak, and Ömer Faruk Sari. 2022. 'The Energy Community and Europeanization of South East Europe and beyond: A Rational Choice - Historical Institutionalist Explanation'. *Journal of Contemporary European Studies* 30 (4): 706–18. p. 711-713 Available from: https://doi.org/10.1080/14782804.2021.1939663.

Nevertheless, this research has set out to find how effectively can the European Union reduce its natural gas dependency on Russian exports by looking at its domestic production with its infrastructure capabilities.

As the evaluation show, there are ways for the European Union to significantly reduce its dependency on Russia, if not entirely remove the country from the equation. This goal, however, is not an easy task since it either requires significant political will against the EU's own ecology commitments or an economic burden that needs to be shouldered by the taxpayers.

As discussed at the beginning of the conclusion, this research attempted to position itself as a snapshot of 2022 while also binding multiple aspects of natural gas into a singular point. By doing so, the research fills the gap in the literature for a short duration, as the reason why this is the case was discussed earlier. The extensive literature coverage and the usage of official databases have granted a significant perspective in evaluating the research question.

Furthermore, perhaps most importantly, the research puts the actual demand for natural gas in the European Union into an understandable perspective. The findings are significant due to a couple of reasons.

Firstly, the research shows a clear difference in how much natural gas is consumed outside of its electricity generation purpose. Indeed, the combined natural gas as a fuel for heating, transportation and raw material for production is comparably more significant than its demand for electricity generation.

The opportunity to differentiate consumption in the first part is important since, with its coverage, the research also gained the opportunity to put the share of renewables into a more transparent plane. While energy generation from renewables is important, one now knows that electricity generation corresponds to only a fraction of the total gas usage. Thus, on the issue of renewables, the EU must make significant progress in other fields such as heat generation and transportation to be more effective.

As the research confirms, there is a significant gap between the production and consumption of natural gas in the European Union. Indeed, the negative trend displayed in the domestic production of gas indicates that the Union is on the path of further dependence. This situation necessitates imports, most of which, came from Russia previously. While pinpointing the exact share of Russia in the EU's gas imports

is not possible due to the untraceable figures in the Eurostat, the examination of the known part shows that Russia constituted almost half of what was imported.

Moreover, this growing gap in consumption versus production consequently plays a crucial role in the security dimension of the European Union. Natural gas, as a component of the grander energy domain, was among the two resources (with the other one being oil) that were specifically mentioned as one of the primary concerns of the EU in the European Security Strategy dating back to 2008.

The research then set out to showcase the attempts of the European Union regarding the natural gas domain. On the infrastructure capability, the EU has attempted to unite its member states' pipelines by making them bi-directional in order to create a network that improved the security of supply. Indeed, several new pipelines were commissioned even during the process of writing this research.

Furthermore, the research also looked at the historical facts regarding the LNG capabilities and actual imports by screening the data. This data observation indicates that the EU, prior to security issues against Russia, did not utilise its LNG capability to its maximum potential and leaned more on the Russian pipeline gas. As explained during the research, the utilisation of pipeline gas is a cheaper alternative compared to LNG imports. One of the consequences of the Russian invasion of Ukraine was that this "cheap" supply that the EU was benefiting from was at risk of being cut, which correspondingly happened during the process of writing this research.

As for the reduction in Russian imports, the research covered two main fields. The first option looked for prospects for increasing the import capacities of the EU.

The new pipelines, while capable of granting a significant boost, require a construction process that can last a quite while. Furthermore, any significant contribution will also have to cover a significant distance as the immediate producers are already supplying the continent.

The increase in LNG capabilities, on the other hand, may grant a more concrete resolution for the EU's case since they can be built within the EU and bring more suppliers rather than a singular exporter. This option, however, brings a conundrum as the price for LNG is ultimately higher than what the European Union has accustomed to.

This is especially the case for imports coming from the US since the country has a high price point for extracting natural gas due to the utilisation of unconventional methods. Shipment of this gas further raises the price of US LNG as the country is converting the already expensive gas into a liquid state. This not only results in higher costs for the EU but also ultimately makes the US more susceptible to price fluctuations. Qatar, on the other hand, might be a better future LNG partner in this regard. As the research discussed, the country is expanding its LNG export capabilities and its price for extracting natural gas is the lowest in the world.

The second option looked for reductions in consumption in order to reduce the dependency on Russian imports. During this part, the research covered the role of natural gas and how it is deemed as a transitionary source for the climate goals of the EU. This means that the EU will continue to utilise this resource for the foreseeable future even with the balance disparity.

In addition, the research also addressed the issue of biogas/biomethane, as they are also relevant to the natural gas sector due to the same characteristics. The biomethane increase in the REPowerEU plan, for example, indicates that the EU aims to produce the main component of natural gas domestically which will unequivocally reduce the import demands. While a comprehensive coverage for the exact reduction of demand or the production efficiency of biomethane was not in the scope of this research, it nonetheless will help the EU's dependency problem. Therefore, a future inquiry on this matter is necessary in order for us to see the bigger picture more clearly.

Transitioning away from natural gas by switching to the other resources is covered in a limited manner. The previously mentioned REPowerEU, for example, seeks to use hydrogen as a fuel source. Furthermore, the EU may also turn to coal at least for its electricity generation, suspending its environmental commitments for the duration of the crisis. The beginning of the coal (re)transition was covered by this research, however, to what extent it will reach is a subject of future research. While a complete transition back to coal seems not possible, the research also acknowledges its limited coverage on the subject of hydrogen and its full potential. Nevertheless, the reduction option is also under pressure as its costs on the ecology and economy might not be sustainable for the EU in the long run.

On a similar trend, nuclear use is also briefly discussed in the evaluation section to provide the most critical shortcoming of the resource. That is nuclear energy itself is mostly used for electricity generation. As discussed in the third chapter of the research, natural gas is used in a variety of fields outside of the electricity domain. That is, even if we ignore whether the member states actually have nuclear plants, from a heating source to a raw material input, only around 15% of the natural gas consumed in the European Union is solely used to create electricity, hence, the actual demand for gas will remain significant.

While the evaluation of the potential 2022 figures shows the annual supply and demand will not be sufficient enough for the complete removal of Russian gas imports, the European Union managed to store up an additional 10 bcm worth of gas -10% more than the binding amount for 2022- before the winter (see Figure 4.11). An increase in infrastructure projects such as the accelerated LNG plants in Germany will take time to provide significant change. Therefore, as the burden on gas increases in the winter, the next year's prospects of lowering the dependency on Russia will mostly bank on the proper management of consumption during this crucial period. It is with this cautionary note one should assess the future of natural gas as it can not be relegated to merely a product of economic importance but rather a vitally strategic one that is predominantly used to heat millions of people across Europe.

REFERENCES

Abnett, Kate, and Simon Jessop. 2022. 'Explainer: What Is the EU's Sustainable Finance Taxonomy?' *Reuters*, 6 July 2022. https://www.reuters.com/business/sustainable-business/what-is-eus-sustainable-finance-taxonomy-2022-02-03/.

Atalayar. 2021. 'Algeria Blames Morocco For Maghreb Gas Pipeline Closure'. *Atalayar*, 1 November 2021. https://atalayar.com/en/content/algeria-blames-morocco-maghreb-gas-pipeline-closure.

Australian Government. 2022. 'Global Resources Strategy Commodity Report: Liquefied Natural Gas'. Department of Industry, Science and Resources. https://www.industry.gov.au/sites/default/files/2022-09/grs-commodity-report-lng.pdf.

Bahmanyar, Alireza, Abouzar Estebsari, and Damien Ernst. 2020. 'The Impact of Different COVID-19 Containment Measures on Electricity Consumption in Europe'. *Energy Research & Social Science* 68: 101683. https://doi.org/https://doi.org/10.1016/j.erss.2020.101683.

Baltic Pipe Project. n.d. 'The Baltic Sea Offshore Pipeline'. Baltic Pipe Project. Accessed 12 October 2022a. https://www.baltic-pipe.eu/dk/the-project/baltic-sea-offshore/.

———. n.d. 'The Project'. Accessed 13 October 2022b. https://www.baltic-pipe.eu/the-project/.

———. 2022. 'ENERGINET: Baltic Pipe Can Be Put into Full Operation One

Month Ahead of Planned'. *Baltic Pipe Project*, 24 September 2022. https://www.baltic-pipe.eu/energinet-baltic-pipe-can-be-put-into-full-operation-one-month-ahead-of-planned/.

BBC. 2022. 'Nord Stream 1: How Russia Is Cutting Gas Supplies to Europe', 29 September 2022. https://www.bbc.com/news/world-europe-60131520.

BBL. n.d. 'About BBL'. BBL Company. https://www.bblcompany.com/about-bbl.

Benali, Arezki. 2021. 'Gaz : Les Capacités d'exportation Du Medgaz Augmenteront à 10,5 Milliards de M3 Fin Novembre'. *Algerie Eco*, 2021. https://www.algerie-eco.com/2021/09/01/gaz-capacites-exportation-medgaz-augmenteront-105-milliards-m3-fin-novembre/.

Bentele, Hildegard. 2022. 'Opinion of the Committee on Development for the Committee on Industry, Research and Energy'. https://www.europarl.europa.eu/doceo/document/DEVE-AD-719604_EN.pdf.

Boehm, Lasse, and Alex Wilson. 2022. 'EU Gas Storage and LNG Capacity as Responses to the War in Ukraine'. https://www.europarl.europa.eu/RegData/etudes/BRIE/2022/729401/EPRS_BRI(2022)729401_EN.pdf.

Bolado, Laura. 2019. '2030 Climate and Energy Framework - Snapshot'. RELX Sustainable Development Goals Resource Centre. 2019. https://sdgresources.relx.com/legal-practical-guidance/2030-climate-and-energy-framework-snapshot.

BP. n.d. 'South Caucasus Pipeline Expansion Project (SCPX)'. BP. https://www.bp.com/en_ge/georgia/home/who-we-are/scp.html#.

———. n.d. 'South Caucasus Pipeline Project'. BP.

https://www.bp.com/en_ge/georgia/home/who-we-are/scp.html.

———. 2020. ‘Statistical Review of World Energy’ 69: 65. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2020-full-report.pdf.

———. 2021. ‘Statistical Review of World Energy’ 70: 34. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2021-natural-gas.pdf.

———. 2022. ‘Statistical Review of World Energy’ 71: 29. https://www.bp.com/content/dam/bp/business-sites/en/global/corporate/pdfs/energy-economics/statistical-review/bp-stats-review-2022-full-report.pdf.

Conti, Ilaria, and James Kneebone. 2022. ‘A First Look at REPowerEU: The European Commission’s Plan for Energy Independence from Russia’. *Florence School of Regulation*, 19 May 2022. https://fsr.eui.eu/first-look-at-repowereu-eu-commission-plan-for-energy-independence-from-russia/.

Corbeau, Anne-Sophie. 2017. ‘LNG Markets in Transition’. *Global Commodities Applied Research Digest* Spring: 112–16. https://www.jpmcc-gcard.com/wp-content/uploads/2017/04/Page-112-116_GCARD-Spring-2017-Commentary-Corbeau.pdf.

Corbeau, Anne-Sophie, and David Ledesma. 2016. ‘LNG Markets in Transition: The Great Reconfiguration’. In , 8. Perth. https://www.kapsarc.org/file-download.php?i=7514.

Council of the European Union. 2009. ‘EU-US Summit’. Washington, DC.

https://www.consilium.europa.eu/uedocs/cms_data/docs/pressdata/en/er/110929.pdf.

———. 2022. '"Fit for 55": Council Agrees on Higher Targets for Renewables and Energy Efficiency'. *Council of the European Union*, 27 June 2022. https://www.consilium.europa.eu/en/press/press-releases/2022/06/27/fit-for-55-council-agrees-on-higher-targets-for-renewables-and-energy-efficiency/.

Davies, Rob. 2022. 'Biden and EU Agree Landmark Gas Deal to Break Kremlin's Hold'. *The Guardian*, 25 March 2022. https://www.theguardian.com/us-news/2022/mar/25/biden-and-eu-agree-landmark-gas-deal-to-break-kremlin-hold.

Department of Energy. 2019. 'Department of Energy Authorizes Additional LNG Exports from Freeport LNG'. Department of Energy. 2019. https://www.energy.gov/articles/department-energy-authorizes-additional-lng-exports-freeport-lng.

Devonshire-Ellis, Chris. 2022. 'Turkmenistan Becomes New Hunting Ground For EU Gas Supplies'. *Silk Road Briefing*, 31 March 2022. https://www.silkroadbriefing.com/news/2022/03/31/turkmenistan-becomes-new-hunting-ground-for-eu-gas-supplies/.

Eckert, Vera, and Francesca Landini. 2022. 'Europe May Shift Back to Coal as Russia Turns down Gas Flows'. *Reuters*, 20 June 2022. https://www.reuters.com/world/europe/europe-may-shift-back-coal-russia-turns-down-gas-flows-2022-06-20/.

EIA. n.d. 'Natural Gas Explained: Natural Gas Imports and Exports'. EIA. https://www.eia.gov/energyexplained/natural-gas/imports-and-exports.php.

———. n.d. 'Oil and Petroleum Products Explained: Oil Imports and Exports'. EIA.

https://www.eia.gov/energyexplained/oil-and-petroleum-products/imports-and-exports.php.

———. 2014. ‘June Marks 50th Anniversary of the First Commercial Liquefied Natural Gas Tanker’. *U.S. Energy Information Administration*, 19 June 2014. https://www.eia.gov/todayinenergy/detail.php?id=16771&src=email.

———. 2021. ‘Frequently Asked Questions’. U.S. Energy Information Administration. 2021. https://www.eia.gov/tools/faqs/faq.php?id=45&t=8.

———. 2022a. ‘Fire Causes Shutdown of Freeport Liquefied Natural Gas Export Terminal’. https://www.eia.gov/todayinenergy/detail.php?id=52859.

———. 2022b. ‘Natural Gas Explained: Natural Gas and the Environment’. U.S. Energy Information Administration. 2022. https://www.eia.gov/energyexplained/natural-gas/natural-gas-and-the-environment.php.

Elliot, Stuart. 2022. ‘Algeria, Niger, Nigeria Pledge Acceleration of Work on Trans-Saharan Gas Link’. *S&P Global*, 21 June 2022. https://www.spglobal.com/commodityinsights/en/market-insights/latest-news/natural-gas/062122-algeria-niger-nigeria-pledge-acceleration-of-work-on-trans-saharan-gas-link.

Empl. 2019. ‘History’. Empl. 2019. http://www.emplpipeline.com.

———. 2020. ‘Expansion’. Empl. 2020. http://www.emplpipeline.com/en/expansion/.

ENTSOG. 2017. ‘CAPACITIES AT CROSS-BORDER POINTS ON THE PRIMARY MARKET’. *THE EUROPEAN NATURAL GAS NETWORK*. https://www.entsog.eu/sites/default/files/2018-09/ENTSOG_CAP_2017_A0_1189x841_FULL_064.pdf.

EUR-Lex. n.d. ‘Assessing Environmentally Sustainable Investments’. EUR-Lex. Accessed 14 October 2022. https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=celex:32020R0852.

———. 2011. ‘Security of Supply of Natural Gas’. EUR-Lex. 2011. https://eur-lex.europa.eu/legal-content/EN/LSU/?uri=CELEX:32010R0994.

———. 2014. ‘Guidelines for Trans-European Energy Infrastructure’. EUR-Lex. 2014. https://eur-lex.europa.eu/legal-content/en/LSU/?uri=celex:32013R0347.

———. 2022. ‘REPowerEU: Joint European Action for More Affordable, Secure and Sustainable Energy’. EUR-Lex. 2022. https://eur-lex.europa.eu/legal-content/EN/TXT/?uri=COM%3A2022%3A108%3AFIN.

European Commission. n.d. ‘2020 Climate & Energy Package’. European Commission. Accessed 13 October 2020a. https://climate.ec.europa.eu/eu-action/climate-strategies-targets/2020-climate-energy-package_en.

———. n.d. ‘EU Taxonomy for Sustainable Activities What the EU Is Doing to Create an EU-Wide Classification System for Sustainable Activities.’ https://finance.ec.europa.eu/sustainable-finance/tools-and-standards/eu-taxonomy-sustainable-activities_en.

———. n.d. ‘Liquefied Natural Gas’. European Commission. Accessed 10 October 2022b. https://energy.ec.europa.eu/topics/oil-gas-and-coal/liquefied-natural-gas_en.

———. 2000. *Green Paper - Towards a European Strategy for the Security of Energy Supply*. https://op.europa.eu/en/publication-detail/-/publication/0ef8d03f-7c54-41b6-ab89-6b93e61fd37c/language-en#.

———. 2018. ‘Joint U.S.-EU Statement Following President Juncker’s Visit to the

White House’. Washington, DC. https://ec.europa.eu/commission/presscorner/detail/en/STATEMENT_18_4687.

———. 2020. ‘Project of Common Interest: 7.1.1 Southern Gas Corridor’. https://ec.europa.eu/energy/maps/pci_fiches/PciFiche_7.1.1.pdf.

———. 2022a. ‘Communication: REPowerEU Plan {SWD(2022) 230 Final}’. Brussels. https://eur-lex.europa.eu/resource.html?uri=cellar:fc930f14-d7ae-11ec-a95f-01aa75ed71a1.0001.02/DOC_1&format=PDF.

———. 2022b. ‘Complementary Climate Delegated Act on Certain Nuclear and Gas Activities’. https://ec.europa.eu/info/sites/default/files/business_economy_euro/banking_and_finance/documents/sustainable-finance-taxonomy-complementary-climate-delegated-act-factsheet_en.pdf.

———. 2022c. ‘EU-U.S. LNG TRADE U.S. Liquefied Natural Gas (LNG) Has the Potential to Help Match EU Gas Needs’. https://ec.europa.eu/energy/sites/ener/files/eu-us_lng_trade_folder.pdf.

———. 2022d. ‘EU-US LNG TRADE’. https://energy.ec.europa.eu/system/files/2022-02/EU-US_LNG_2022_2.pdf.

———. 2022e. ‘In Focus: Reducing the EU’s Dependence on Imported Fossil Fuels’. European Commission. 2022. https://ec.europa.eu/info/news/focus-reducing-eus-dependence-imported-fossil-fuels-2022-apr-20_en.

———. 2022f. ‘Joint Statement by President von Der Leyen and President Biden on U.S.- EU Cooperation on Energy Security’. Brussels. https://ec.europa.eu/commission/presscorner/api/files/document/print/en/statement_22_664/STATEMENT_22_664_EN.pdf.

———. 2022g. ‘Natural Gas Supply Statistics’. European Commission. 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Natural_gas_supply_statistics#Supply_structure.

———. 2022h. ‘Questions and Answers on the New EU Rules on Gas Storage’. European Commission. 2022. https://ec.europa.eu/commission/presscorner/detail/en/QANDA_22_1937.

———. 2022i. ‘REPowerEU: Affordable, Secure and Sustainable Energy for Europe’. European Commission. 2022. https://ec.europa.eu/info/strategy/priorities-2019-2024/european-green-deal/repowereu-affordable-secure-and-sustainable-energy-europe_en.

———. 2022j. ‘Statement by President von Der Leyen with US President Biden’. Brussels. https://ec.europa.eu/commission/presscorner/detail/en/statement_22_2043.

———. 2022k. ‘EU Taxonomy: Complementary Climate Delegated Act to Accelerate Decarbonisation’. *European Commission*, 2 February 2022. https://finance.ec.europa.eu/publications/eu-taxonomy-complementary-climate-delegated-act-accelerate-decarbonisation_en.

European Council. 2022. ‘The Versailles Declaration, 10 and 11 March 2022’. Versailles. https://www.consilium.europa.eu/media/54773/20220311-versailles-declaration-en.pdf.

European Parliament. n.d. ‘Energy Policy: General Principles’. European Parliament. https://www.europarl.europa.eu/factsheets/en/sheet/68/energy-policy-general-principles.

Eurostat. n.d. ‘Complete Energy Balances Data’. Eurostat. https://ec.europa.eu/eurostat/cache/infographs/energy_balances/enbal.html.

———. n.d. ‘Energy Imports Dependency (Nrg_Ind_Id) Reference Metadata’. Eurostat. https://ec.europa.eu/eurostat/cache/metadata/en/nrg_ind_id_esms.htm.

———. n.d. ‘From Where Do We Import Energy?’ European Commission. Accessed 17 March 2022. https://ec.europa.eu/eurostat/cache/infographs/energy/bloc-2c.html#carouselControls?lang=en.

———. n.d. ‘Glossary:Gross Inland Energy Consumption’. Eurostat. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Gross_inland_energy_consumption.

———. n.d. ‘Imports of Natural Gas by Partner Country’. Eurostat. https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GAS__custom_2416827/default/table?lang=en.

———. n.d. ‘Stock Levels for Gaseous and Liquefied Natural Gas’. Eurostat. https://ec.europa.eu/eurostat/databrowser/view/NRG_STK_GAS__custom_3494301/default/table?lang=en.

———. n.d. ‘Supply, Transformation and Consumption of Gas’. Eurostat. https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_2322411/default/table?lang=en.

———. n.d. ‘Supply, Transformation and Consumption of Gas (NRG_CB_GAS)’. Eurostat. https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GAS__custom_3594043/default/line?lang=en.

———. n.d. ‘Trade by Partner Country (Nrg_t) Reference Metadata’. Eurostat. https://ec.europa.eu/eurostat/cache/metadata/en/nrg_t_esms.htm.

———. 2020. *Energy Data — 2020 Edition*. 2020th ed. Luxembourg: Publications Office of the European Union. https://ec.europa.eu/eurostat/documents/3217494/11099022/KS-HB-20-001-EN-N.pdf/bf891880-1e3e-b4ba-0061-19810ebf2c64?t=1594715608000.

———. 2022a. ‘Complete Energy Balances (NRG_BAL_C)’. https://ec.europa.eu/eurostat/databrowser/bookmark/2ae30e16-3346-45bd-9217-0334b080dc17?lang=en.

———. 2022b. ‘Glossary: Energy Dependency Rate - Statistics Explained’. Eurostat. 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Glossary:Energy_dependency_rate.

———. 2022c. ‘Imports of Natural Gas by Partner Country - Monthly Data (NRG_TI_GASM)’. 2022. https://ec.europa.eu/eurostat/databrowser/view/NRG_TI_GASM__custom_3595752/default/table?lang=en.

———. 2022d. ‘Nuclear Energy Statistics’. Eurostat. 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Nuclear_energy_statistics#Nuclear_heat_and_gross_electricity_production.

———. 2022e. ‘Renewable Energy Statistics’. Eurostat. 2022. https://ec.europa.eu/eurostat/statistics-explained/index.php?title=Renewable_energy_statistics#Share_of_renewable_energy_more_than_doubled_between_2004_and_2020.

———. 2022f. ‘Share of Energy from Renewable Sources (NRG_IND_REN)’. https://ec.europa.eu/eurostat/databrowser/view/NRG_IND_REN__custom_3578192/default/table?lang=en.

———. 2022g. ‘Supply, Transformation and Consumption of Gas - Monthly Data [NRG_CB_GASM__custom_3594950]’. Eurostat. 2022. https://ec.europa.eu/eurostat/databrowser/view/NRG_CB_GASM__custom_3594950/default/table?lan%09g=en.

Fluxys. n.d. ‘Interconnector Infrastructure’. Fluxys. https://www.fluxys.com/en/company/interconnector-uk/infrastructure.

Foss, Michelle Michot, and Gürcan Gülen. 2016. ‘Is U.S. LNG Competitive?’ *IAEE Energy Forum* Q3: 33–36. https://www.iaee.org/en/publications/newsletterdl.aspx?id=342.

Frost, Rosie. 2022. ‘All the European Countries Returning to “Dirty” Coal as Russia Threatens to Turn off the Gas Tap’. *Euronews*, 24 June 2022. https://www.euronews.com/green/2022/06/24/all-the-european-countries-returning-to-dirty-coal-as-russia-threatens-to-turn-off-the-gas.

FSR. 2020. ‘The Clean Energy for All Europeans Package’. Florence School of Regulation. 2020. https://fsr.eui.eu/the-clean-energy-for-all-europeans-package/.

Gas for Climate. 2022. ‘Commission Announces Groundbreaking Biomethane Target: “REPowerEU to Cut Dependence on Russian Gas”’. *Gas for Climate*, 8 March 2022. https://gasforclimate2050.eu/news-item/commission-announces-groundbreaking-biomethane-target-repowereu-to-cut-dependence-on-russian-gas/.

Gas Infrastructure Europe. 2019. ‘LNG MAP Existing & Planned Infrastructure 2019’. https://www.gie.eu/download/maps/2019/GIE_LNG_2019_A0_1189x841_FULL_Final3.pdf.

Gazprom. 2022. ‘Gazprom In Figures 2015–2019 Factbook’. http://gazprom.com/f/posts/72/802627/gazprom-in-figures-2015-2019-en.pdf.

‘Greenstream Pipeline’. n.d. Global Energy Monitor Wiki. Accessed 4 October 2022. https://www.gem.wiki/Greenstream_Pipeline.

Gurzu, Anca. 2019. ‘Nord Stream 2 Sues the EU over New Gas Rules’. *SEPTEMBER 26*, 2019. https://www.politico.eu/article/nord-stream-2-sues-the-eu-over-new-gas-rules/.

Harris, Shane, and Paul Sonne. 2021. ‘Russia Planning Massive Military Offensive against Ukraine Involving 175,000 Troops, U.S. Intelligence Warns’. *The Washington Post*, 3 December 2021. https://www.washingtonpost.com/national-security/russia-ukraine-invasion/2021/12/03/98a3760e-546b-11ec-8769-2f4ecdf7a2ad_story.html.

Hieminga, Gerben, Nadège Tillier, and Leszek Kasek. 2022. ‘Back to Black: The Countries Best Positioned to Replace Russian Gas with Coal’. *ING*, 27 June 2022. https://think.ing.com/articles/the-countries-best-positioned-to-replace-russian-gas-with-coal.

IEA. 2019. *LNG Market Trends and Their Implications*. Paris: OECD. https://doi.org/10.1787/90c2a82d-en.

———. 2020a. ‘Global Gas Security Review 2020’. https://iea.blob.core.windows.net/assets/15a3ec72-1bf2-47a1-8b6c-e45e858cfcd8/Global_Gas_Security_Review_2020.pdf.

———. 2020b. ‘Outlook for Biogas and Prospects for Organic Growth’. *World Energy Outlook Special Report*. https://iea.blob.core.windows.net/assets/03aeb10c-c38c-4d10-bcec-de92e9ab815f/Outlook_for_biogas_and_biomethane.pdf.

———. 2022. ‘Database Documentation’. http://wds.iea.org/wds/pdf/gas_documentation.pdf.

Kelsey, Timothy W., Mark D. Partridge, and Nancy E. White. 2016. ‘Unconventional Gas and Oil Development in the United States: Economic Experience and Policy Issues’. *Applied Economic Perspectives and Policy* 38 (2): 191–214. https://doi.org/10.1093/aepp/ppw005.

Kinkartz, Sabine. 2022. ‘Germany’s Energy U-Turn: Coal Instead of Gas’. *DW*, 4 August 2022. https://www.dw.com/en/germanys-energy-u-turn-coal-instead-of-gas/a-62709160.

Langsdorf, Susanne. 2011. *EU Energy Policy: From the ECSC to the Energy Roadmap 2050*. Green European Foundation. http://archive.gef.eu/uploads/media/History_of_EU_energy_policy.pdf.

Le Monde. 2022. ‘Despite Climate Commitments, the EU Is Going Back to Coal’, 2 September 2022. https://www.lemonde.fr/en/economy/article/2022/09/02/despite-climate-commitments-the-eu-is-going-back-to-coal_5995594_19.html.

London School of Economics and Political Science. n.d. ‘2020 Climate and Energy Package’. Grantham Research Institute on Climate Change and the Environment and Sabin Center for Climate Change Law. https://climate-laws.org/geographies/european-union/laws/2020-climate-and-energy-package-contains-directive-2009-29-ec-directive-2009-28-ec-directive-2009-31-ec-and-decision-no-406-2009-ec-of-the-parliament-and-the-council-see-below.

Ma, Richie Ruchuan, Tao Xiong, and Yukun Bao. 2021. ‘The Russia-Saudi Arabia Oil Price War during the COVID-19 Pandemic’. *Energy Economics* 102: 105517. https://doi.org/https://doi.org/10.1016/j.eneco.2021.105517.

Medgaz. n.d. ‘Timetable’. Medgaz. Accessed 4 October 2022. https://www.medgaz.com/medgaz/pages/fases_calendario-eng.htm.

———. 2019. ‘Press Release’. https://www.medgaz.com/medgaz/pages/nota_prensa_35-eng.htm.

Meza, Abel, and Muammer Koç. 2021. ‘The LNG Trade between Qatar and East Asia: Potential Impacts of Unconventional Energy Resources on the LNG Sector and Qatar’s Economic Development Goals’. *Resources Policy* 70 (March): 101886. https://doi.org/10.1016/j.resourpol.2020.101886.

MMEC. 2022. ‘Mozambique International Mining & Energy Conference and Exhibition’. https://mozambiqueoilmining.com/industry_news/the-signature-of-the-multibillion-dollar-trans-saharan-gas-pipeline-a-major-outcome-of-ecomof-2022/.

Nehme, Dahlia. 2019. ‘Qatar Plans to Boost LNG Production to 126 Million Tonnes by 2027’. *Reuters,* 25 November 2019. https://www.reuters.com/article/qatar-energy-qp-idINKBN1XZ1HM.

Norouzi, Nima. 2021. ‘Post-COVID-19 and Globalization of Oil and Natural Gas Trade: Challenges, Opportunities, Lessons, Regulations, and Strategies’. *International Journal of Energy Research* 45 (10): 14338–56. https://doi.org/10.1002/er.6762.

O’Byrne, David. 2021. ‘New American Company Seeks to Realize Trans-Caspian Pipe Dream’. *Eurasianet,* 1 December 2021. https://eurasianet.org/new-american-company-seeks-to-realize-trans-caspian-pipe-dream.

Ofgem. 2019. ‘Impact Assessment’. https://www.ofgem.gov.uk/sites/default/files/docs/2019/12/impact_assessment_0.pdf.

Oil Voice. 2006. ‘Azerbaijan’s Shah Deniz Field On Stream’, 2006. https://web.archive.org/web/20160306024611/http:/www.oilvoice.com/n/Azerbaijans_Shah_Deniz_Field_On_Stream/6f7f7be8.aspx.

OPEC. 2022a. ‘Algeria Facts and Figures’. OPEC. 2022. https://www.opec.org/opec_web/en/about_us/146.htm.

———. 2022b. ‘Libya Facts and Figures’. OPEC. 2022. https://www.opec.org/opec_web/en/about_us/166.htm.

Pacces, Alessio M. 2021. ‘Will the EU Taxonomy Regulation Foster Sustainable Corporate Governance?’ *Sustainability* 13 (21): 12316. https://doi.org/10.3390/su132112316.

Parraga, Marianna. 2022. ‘More U.S. LNG Heads to Europe despite Output Constraints’. *Reuters*, 3 October 2022. https://www.reuters.com/business/energy/more-us-lng-heads-europe-despite-output-constraints-2022-10-03/.

Percebois, Jacques. 2008. ‘The Supply of Natural Gas in the European Unionstrategic Issues’. *OPEC Energy Review* 32 (1): 33–53. https://doi.org/10.1111/j.1753-0237.2008.00142.x.

Qarjouli, Asmahan. 2022. ‘Qatar’s LNG Exports to Europe Increase in January amid Rising Demand’. *Dohanews*, 21 February 2022. https://dohanews.co/qatars-lng-exports-to-europe-increase-in-january-amid-rising-demand/.

Qatargas. n.d. ‘History’. Accessed 12 October 2022. https://www.qatargas.com/english/aboutus/history.

Rodríguez-Gómez, Nuria, Nicola Zaccarelli, and Ricardo Bolado-Lavín. 2016.

Improvement in the EU Gas Transmission Network between 2009 and 2014. Publications Office. https://doi.org/10.2790/708926.

Romei, Valentina, and Martin Arnold. 2022. 'Germany Turns to Coal for a Third of Its Electricity'. *Financial Times,* 7 September 2022. https://www.ft.com/content/9d3c8af8-ae00-4dc5-9e85-579681450c9c.

Russel, Martin. 2021. 'The Nord Stream 2 Pipeline Economic, Environmental and Geopolitical Issues'. https://www.europarl.europa.eu/RegData/etudes/BRIE/2021/690705/EPRS_BRI(2021)690705_EN.pdf.

Sandford, Alasdair. 2022. 'Baltic Pipe: Norway-Poland Gas Pipeline Opens in Key Move to Cut Dependency on Russia'. *Euronews,* 27 September 2022. https://www.euronews.com/2022/09/27/baltic-pipe-norway-poland-gas-pipeline-opens-in-key-move-to-cut-dependency-on-russia.

Schwikowski, Martina. 2022. 'African Countries Seek to Revive Trans-Saharan Gas Pipeline Dream'. *DW*, 12 August 2022. https://p.dw.com/p/4FPbN.

'South Caucasus Gas Pipeline'. n.d. Global Energy Monitor Wiki. https://www.gem.wiki/South_Caucasus_Gas_Pipeline.

Southern Gas Corridor. n.d. 'South Caucasus Pipeline (SCP)'. Southern Gas Corridor. Accessed 4 October 2022. https://www.sgc.az/en/project/scp.

Tagliapietra, Simone. 2014. 'Turkey as a Regional Natural Gas Hub: Myth or Reality? An Analysis of the Regional Gas Market Outlook, Beyond the Mainstream Rhetoric'. *SSRN Electronic Journal*. https://doi.org/10.2139/ssrn.2384492.

TANAP. n.d. 'Project Background'. TANAP. https://www.tanap.com/en/project-

background .

———. n.d. ‘Route and Above Ground Installations’. TANAP. Accessed 5 October 2022. https://www.tanap.com/en/route-above-ground-installations.

Tangör, Burak, and Ömer Faruk Sari. 2022. ‘The Energy Community and Europeanization of South East Europe and beyond: A Rational Choice - Historical Institutionalist Explanation’. *Journal of Contemporary European Studies* 30 (4): 706–18. https://doi.org/10.1080/14782804.2021.1939663.

The Court of Justice of the European Union. 2019. ‘Action Brought on 25 July 2019 – Nord Stream 2 v Parlement and Conseil (Case T-526/19)’.

‘Trans-Mediterranean Natural Gas Pipeline’. n.d. Hydrocarbons Technology. https://www.hydrocarbons-technology.com/projects/trans-med-pipeline/.

Trans Adriatic Pipeline. n.d. ‘How TAP Operates’. Trans Adriatic Pipeline. Accessed 15 October 2022. https://www.tap-ag.com/infrastructure-operation/how-tap-operates.

———. n.d. ‘Pipeline Facts and Figures’. Trans Adriatic Pipeline. https://www.tap-ag.com/infrastructure-operation/pipeline-facts-and-figures.

———. n.d. ‘TAP to Deliver the First Gas Exit Point in Fier, Albania’. Trans Adriatic Pipeline. https://www.tap-ag.com/news/news-stories/tap-to-deliver-the-first-gas-exit-point-in-fier-albania.

Troianovski, Anton, and Neil MacFarquhar. 2022. ‘Putin Announces Start to “Military Operation” Against Ukraine’. *The New York Times*, 23 February 2022. https://www.nytimes.com/2022/02/23/world/europe/ukraine-russia-invasion.html.

UN Climate Change Secretariat. n.d. ‘Status of Ratification of the Convention’. United Nations Framework Convention on Climate Change Secretariat. https://unfccc.int/process-and-meetings/the-convention/status-of-ratification-of-the-convention.

Vivoda, Vlado. 2022. ‘LNG Export Diversification and Demand Security: A Comparative Study of Major Exporters’. *Energy Policy* 170 (November): 113218. https://doi.org/10.1016/j.enpol.2022.113218.

Wood, David A. 2012. ‘A Review and Outlook for the Global LNG Trade’. *Journal of Natural Gas Science and Engineering* 9: 16–27. https://doi.org/https://doi.org/10.1016/j.jngse.2012.05.002.

World Health Organization. 2020. ‘Pneumonia of Unknown Cause – China’. World Health Organization. 2020. https://www.who.int/emergencies/disease-outbreak-news/item/2020-DON229.

Yergin, Daniel. 2020. *The New Map: Energy, Climate, and the Clash of Nations*. 1st ed. New York: Penguin Press.

Zachmann, Georg, Giovanni Sgaravatti, and Ben McWilliams. 2022. ‘European Natural Gas Imports’. https://www.bruegel.org/dataset/european-natural-gas-imports.

APPENDICES

A. TURKISH SUMMARY / TÜRKÇE ÖZET

Bu çalışma, Avrupa Birliği'nin enerji bağlamında doğal gaz ile olan ilişkisini kapsamlı bir şekilde incelemeye ve Rusya'ya olan bağımlılığınını ne ölçüde azaltılabileceğini değerlendirmeyi amaçlamıştır. Bu doğrultuda, Avrupa Birliği'nin altyapısı gerek başlangıç noktası Rusya olmayan boru hatları ve gerekse üye ülkelerin sıvılaştırılmış doğal gaz ısıtma terminallerinin kapasiteleri üzerinden mercek altına alınmıştır.

Araştırma, yapısı gereği doğal gaz sektörünü, üretim ve tüketim miktarları, ticari hacim, kalan rezerv, ihracat etme çeşitleri ve geleneksel olmayan çıkarma yöntemlerini paylaşarak genel anlamda sabitleyici bir durum üzerinde ele almıştır.

Bu tarzın benimsenmesinde sektörün özellikle son yıllarda deneyimlemiş olduğu inişler ve çıkışlar göze alınmıştır. Araştırma süresince yaşanan COVID-19 Pandemisi ve Rusya-Ukrayna çatışması gibi faktörler, gerek dünyayı gerekse Avrupa Birliği'ni doğal gaz konusunda da derinden etkilemiş olduğundan, ilk bölümlerde kullanılan veriler eski tarihlerden alınmış olup, Avrupa Birliği'nin bu olaylardan isole edildiğindeki halini genel hatlarıyla görme imkanını sağlama amacı gütmektedir.

Bu süreçte toplam enerji tüketimi ve milyar metreküp/yıl değerleri araştırmanın daha kolay bilgi aktarması açısından standart olarak benimsenmiş ve araştırma tarafından yaygın bir biçimde kullanılmıştır.

Genel hatların çizilmesinin ardından araştırma, konu alanını daha fazla Avrupa Birliği'ne odaklamış, başlangıç noktası Rusya dışında kalan ve AB üye ülkelerine ulaşan bütün doğal gaz boru hatlarının yıllık kapasitelerini, AB LNG terminalleri ve kapasiteleriyle tek bir yerde toplamıştır.

Araştırmada hukuksal boyutta AB'nin doğal gaz üzerine atmış olduğu adımlardan da söz edilmiştir. Bu yakın mercek altına alım sonrasında doğal gazı

etkileyen güncel unsurlar konuya daha sonradan dahil edilmiş olup, bu olayların etkilerinden kısaca bahsedilmiştir.

Güncel olayların ele alınmasının ardından araştırma, üç alt başlık altında AB'nin Rusya'ya karşı kullanabileceği alternatifleri sıralayarak, bu ülkeye karşı doğal gaz bağımlılığını ne kadar azaltabileceğini değerlendirme imkanı sağlamıştır. Değerlendirme başlıkları: daha fazla LNG ithal edilmesi, yeni boru hatlarının potansiyelleri ve yenilenebilir enerji kaynaklarına yönelme şeklinde ele alınmıştır.

Araştırma yapılan değerlendirme sonrasında, bu alternatiflerden en öncül olanının daha fazla LNG ithal edilmesi seçeneği olarak belirlemiştir.

Detaylara inilecek olduğunda, araştırmanın standart olarak benimsediği milyar metreküp ölçeği bile doğal gazın kalitesinin değişmesi ve ülkelerin farklı basınçlar ve sıcaklıklar altında ölçüm yapmaları nedeniyle farklılık göstermektedir. Bu yüzden, araştırmanın yeni gelişmeler ışığında sürekli farklı bir boyuta taşınan konu hakkında kesinlik içerisinde genel bir değerlendirme yapması zorluk teşkil etmektedir. Bu duruma rağmen araştırma, ileri dönemlerde oluşabilecek durumların daha kolay ele alınabilmesi için ihtiyaç duyulacak bütün birimler hakkında açıklamalar yaparak bu alanları detaylandırmış, yeni ölçümler yapılacağı zamanda da ihtiyaç duyulacak olan kritik veri kaynaklarını paylaşmıştır.

Uygulanan vizyonda gerekli duyulan veri çokluğu araştırmayı Avrupa Birliği'ni bir bütün halinde ele almaya yönlendirmiştir. Bu aşamada üye devletlerin genel anlamıyla birbiriyle olan sınır aşırı doğal gaz boru hatlarının iki yönde de gaz aktarımı gerçekleştirebilme imkanı yatmaktadır. Aynı zamanda, Enerji Topluluğu gibi AB'nin enerji bağlamında yakın ilişkiler içerisinde bulunduğu AB üyesi olmayan devletler de, yapılan genel değerlendirmeye dahil edilmemiştir.

Güncel olaylardan ayrı bir durumda bakıldığında AB'nin doğal gaz toplam enerji tüketimi yıllık olarak yaklaşık 400 milyar metreküp seviyesinde seyretmektedir. 2020 yılı için tüketim değerlerine bakıldığında ise AB genelinde doğal gaz, büyük ölçüde (%57) ısınma amaçlı olarak kullanılmaktadır. Bu durumu %33 oranıyla enerji üretimi takip etmektedir.

Avrupa Birliği'nin doğal gaz üretim miktarına bakıldığında, 1990-2019 aralığında genel anlamda düşüş görülmektedir. Üçüncü milenyuma girildiğinde yıllık ortalama 150 milyar metreküp doğal gaz üretimi gerçekleştiren AB, son yıllarda bu

seviyenin ancak üçte birine ulaşabilmektedir. Eurostat tarafından 2021 yılı için verilen aylık üretim miktarları toplandığında, bu seviye 50.5 milyar metreküp olarak bulunmuştur. Yine aynı veritabanının 2022 Ocak-Temmuz toplamları kıyaslandığında ise geçen yıla oranla %10'luk bir düşüş görülmektedir. Bu azalma yıl üzerinden hesaplanıldığında, 2022 için toplam üretimin 45.45 milyar metreküp olacağı araştırma tarafından ön görülmektedir. 2019 verileri tekrardan göz önünde bulundurulduğunda, Avrupa Birliği'nin toplam doğal gaz ihtiyacının sadece %17'sini kendi imkanlarıyla sağlayabildiği görülmüştür. Bu durumda, AB'nin kendi üretimiyle karşılayabileceği oran da 2022 yılında düşük olacaktır.

2019 verilerine bakıldığında, Avrupa Birliği doğal gazını büyük ölçüde Rusya'dan (%42) temin etmektedir. Bu sıralamayı Norveç (%16), Cezayir (%8), Katar (%5), Nijerya ve ABD (%3) takip etmektedir. Bu durum, doğal gazı, ithalat açığı artmakta olan bir kaynak konumudan çıkartıp, enerji başlığı altında AB için bir güvenlik meselesi haline de getirmektedir.

AB'nin doğal gaz ithal etme imkanlarına bakıldığında, Rusya merkezli olmayan boru hatları 3 ana doğrultuda bulunmaktadır. Kuzey doğrultusunda bulunan Norveç, Avrupa Birliği için önemli bir partner olmakla birlikte bu ülkeden gaz transferi gerçekleşitirebilecek boru hatlarının yıllık kapasitesi 89.8 milyar metreküp olarak bulunmuştur (yeni açılan Baltık hattı da dahil edilirse bu seviye 10 milyar metreküp daha artmaktadır.). Birleşik Krallık, doğal gaz ithal eden bir ülke olmasına rağmen, eğer iki yönlü boru hatlarını kullanarak Birlik'e gaz akışı gerçekleştirirse, sağlayabileceği maksimum potansiyel yıllık 31 milyar metreküp seviyesinde olacaktır. Güney yönünde bulunan Cezayir ise, transit ülkeler ile birlikte Avrupa Birliği'ne yıllık 55.5 milyar metreküp gaz transferi yapma imkanına sahiptir. Buna ek olarak, Libya da yıllık 11 milyar metreküp kapasiteye sahip boru hattının başlangıç noktası olmaktadır. Doğu yönüne bakıldığındaysa, Azerbaycan'dan başlayan ve sırasıyla Gürcistan ve Türkiye'yi (TANAP) transit geçen boru hattı, başlangıcı Yunanistan olan TAP projesine bağlanmasıyla AB geneline yıllık ancak 10 milyar metreküp gaz transferi gerçekleştirebilmektedir.

LNG imkanlarına bakıldığında Avrupa Birliği'nin yıllık ithal kapasitenin 160 milyar metreküp olduğu görülmektedir. 2019 verilerine göre AB, bu kapasitenin

yaklaşık olarak yarısını kullanmıştır. Dolayısıyla, potansiyel LNG ithal miktarının yarısı kısa bir süre içerisinde mevcut sisteme dahil edilebilir bir durumdadır.

Bu bilgilendirme ardından araştırma, Avrupa Birliği'nin hukuksal boyutta doğal gazı ilgilendiren gelişmeleri dahil etmiş ve güncel yaşanan olayları da bu çerçeveyle açıklamaya çalışmıştır.

Öncelikle AB'de meydana gelen yasal düzenlemeler, enerji piyasasında ayrımcılık yapmama ve sahada yeni gelenlere açıklık ile liberalleşme hedefleriyle başlamıştır. Araştırma, ayrıca gaz üreticileri ile boru hatlarını ayrıştırma fikrini, tekelleri ortadan kaldırma hedeflerini ve AB'de enerji için serbest ve rekabetçi bir ortak pazar yaratma girişimlerini de üçüncü bölümde açıklamaya çalıştı. Yine bu bölümde araştırma, AB yasal çerçeve eylemlerinin, doğal gazın yerli üretim performansının düştüğüne dair gözlemleri belirtmesiyle, doğal gaz arz güvenliği konusunun da Birlik genelinde daha fazla yaygınlaştığına işaret etmektedir. Özellikle bu noktada Avrupa Birliği'nde, arz güvenliği ve ortak pazar hedeflerinin, AB çapında enerji istatistikleri hakkında bilgi toplamak için ACER ve ENTSOG gibi kurumların ortaya çıkmasıyla daha kapsamlı bir süreç haline geldiği görülmüştür. Bu kuruluşlar, yapıları gereği yıllık raporlar ve kalkınma planları yayınlamanın yanı sıra AB çapında bir altyapı ve piyasa kuralları oluşturmakla görevli oldukları için AB için önemli bir rol oynamaktadır.

2009 gaz krizinin ardından AB'nin vermiş olduğu tepki, Kuzey Akım 2 ve 2022 Rusya-Ukrayna Savaşı'nın yaratmış olduğu Birlik içindeki yasal süreçler gibi Rusya ile ilgili bazı konulara da yine bu bölümde değinilmiştir. Üye devletler arasındaki boru hatlarının yeniden düzenlenerek çift yönlü gaz aktarımı gerçekleştirebilecek kapasitelere dönüştürülmeleri de bu aşamada aktarılmıştır. Bu hareket kabiliyeti, doğal gazın her iki yöne de gönderilmesini, böylece ihtiyaç halinde akışın tersine çevrilebilmesini sağlamıştır.

Ayrıca AB, gelecekte yaşanabilecek kriz durumları için en az 30 günlük doğal gaz stoku yapmaya da başlamıştır. Tüm üye devletlerin acil bir durumda birbirlerine yardım etmeye çalışacaklarını garanti ettikleri dayanışma mekanizmasının kurulması da yine bu bölümde ele alınmaktadır.

REPowerEU planının oluşturduğu uzlaşma ile bu dayanışma protokolü, 2022'de Rusya'nın Ukrayna'yı ikinci kez işgal etmesinden sonra daha da güçlendirildi.

Araştırmanın literatürde yapmış olduğu gözlemlere göre bu dayanışma protokolünde, gaz ihtiyacını karşılayamayacak durumda olan üye devletlere, diğer üye devletlerin gaz aktarımı gerçekleştirmesi şeklinde olduğu aktarılmıştır.

Rusya-Ukrayna çatışmasının yaratmış olduğu sonuçlardan bir tanesi de Avrupa Birliği'nin doğal gaz konusunda hukuksal alanda bağlayıcılık taşıyan ve 30 Haziranda yürürlüğe giren (AB) 2022/1032 sayılı Tüzük olmuştur. Rusya'nın Ukrayna'ya karşı başlatmış olduğu ikinci işgalinin AB üye devletlerinde yaratmış olduğu yankı, üyelerin gaz stoklarını yıl sonuna kadar %80'e kadar doldurmak üzere saklamayı kabul etmesi şeklinde sonuçlanmıştır. Bu %80 dolum hedefi ise sadece 2022 yılı için geçerli olup 2023 ve sonrası için üye devletlerin gaz stoklarının yıl sonunda %90'a ulaşmasını hedeflemektedir. Bu Tüzük üye devletler için bağlayıcı bir nitelikte olmasının yanı sıra olası bir enerji krizinde ortaya çıkacak enerji ihtiyacını en azda tutmayı hedeflemektedir.

İşgal öncesi gerçekleşen bir diğer olay ise 2018 yılında imzalanan ABD-AB LNG sözleşmesi olmuştur. Bu sözleşmenin ardından ABD'nin Avrupa Birliği'ye yaptığı LNG ihracatındaki artış dikkat çekici bir niteliktedir. Her iki taraf da Rusya'ya karşı benzer tutumlarda bulunduğu için, bu işbirliğinin bağları genişletmesi ve derinleştirmesi muhtemeldir. Yakın dönemlere denk gelen COVID-19 Pandemisi ve Rusya ile Suudi Arabistan arasındaki Fiyat Savaşı gibi olaylar ise sadece talebin azalmasına yol açmamış, aynı zamanda doğal gaz fiyatını da düşürmüştür.

Bu gelişmeler ışığında araştırma, alternatiflere odaklanıp onlara değerlendirmeye almış ve genel anlamda bu değerlendirmelerini paylaşmıştır.

Eurostat ve BP'nin verdiği verileri karşılaştırdığımızda, LNG ticaretinde lider olan ilk beşli içinde sadece Katar, ABD ve Rusya'nın AB ile önemli miktarda LNG ticareti yaptığını görmekteyiz. Rusya ile yenilenen gerilim ortamı ithalat oranlarını etkileyeceğinden araştırma, LNG ithalatının gelecekteki beklentilerinin incelenmesinde partner ülkelerin daha fazla denetlenmesinin çok önemli olduğunu belirtmiştir. Bu beşli içinde bulunan Avustralya ve Malezya önemli oranda LNG ihracatına sahipken, Avrupa Birliği ile aralarındaki mesafe büyük bir engel teşkil etmekte ve AB pazarına erişimi kısıtlamaktadır. Araştırmada LNG alanındaki uzaklık ve Asya pazarlarının özellikle fiyat hakimiyeti konuları 2.3.2. bölümünde kısmen açıklanmaktadır. Avustralya örneğinde ise araştırma, hükümetin strateji raporuna

bakarak, ülkenin önümüzdeki 30 yıl için Asya pazarlarına LNG satışını öncelik olarak belirlediğini paylaşmıştır.

Bu değerlendirmeler ardından araştırma, Avrupa Birliği'nin varolan yüksek hacimli partnerlerine odaklanıp, bu ilişkilerin gelecek değerlendirilmesi için ışık tutmaya çalışmıştır.

Amerika Birleşik Devletleri'nin 2000'lerin başında fosil yakıtların çıkarılması için geleneksel olmayan yöntemleri kullanması, ülkenin doğal gaz alanında çok önemli bir rol değişikliğiyle sonuçlandı. Bölüm 2.4'te de kısaca açıklandığı gibi, Amerika Birleşik Devletleri'nde fosil yakıtların çıkarılmasına yönelik geleneksel olmayan yöntem, ülkenin bu yakıtlara olan bağımlılığının tersine çevrilmesinde çok önemli bir rol oynamış ve ülkeyi net doğal gaz ithal eden konumdan net ihraç yapabilecek bir hale getirmiştir. ABD-AB LNG Ortaklığına bakacak olursak, Avrupa Komisyonu tarafından Şubat 2022'de yayınlanan bilgi notuna göre ABD, doğal gaz üretiminde lider olmasının yanı sıra üretimini ve ihracatını daha da artırma niyeti belirtilmektedir. Benzer şekilde, makale iki taraf arasında büyüyen bir LNG trafiğini de ortaya koymaktadır. Bu nedenle ABD ile AB arasında gözlemlenebilen olumlu eğilimin gelecekte daha fazla işbirliğinin resmini çizdiğini varsaymak yanlış olmayacaktır. Aynı şekilde, Rusya'nın Ukrayna'ya yönelik saldırganlığına her iki taraf da karşı çıktığı için bu eğilim daha da hızlanabilir. Fakat, Amerika Birleşik Devletleri'nin, gelecekte yapabileceği doğal gaz ihracatında bazı kısıtlamalar olacağını da göz önünde bulundurmamız gerekmektedir.

ABD'de gaz çıkarmanın başarı öyküsü gerçekte iki ucu da keskin bir kılıç halindedir. Şekil 4.2'de görüldüğü gibi ABD, doğal gaz bağımsızlığını büyük ölçüde geleneksel olmayan yöntemlere dayanarak elde etmiştir.

Bölüm 2.4'te açıklanan geleneksel olmayan kaynak çıkarma yöntemlerinin geleneksel yöntemlerden nispeten daha maliyetli olması ve ABD'nin toplam doğal gaz üretiminin %86'sının bu geleneksel olmayan yöntemlerden elde etmesi, sürdürülebilirliğin yüksek fiyatlarla devam edebileceğini işaret etmektedir. Dolayısıyla geleneksel olmayan yöntemler, ABD'nin enerji bağımsızlığını kazanmasına yardımcı olsa da, bu eylemler yüksek maliyetlerle sonuçlanmıştır. Bu maliyet konusuna ek olarak, ABD de çıkarılacak olan doğal gazın Avrupa'ya arzı için kat edilmesi gereken mesafe de LNG yönteminin kullanılmasını zorunlu kılmaktadır.

Bu süreçte araştırmanın da belirtmiş olduğu gibi, doğal gazın sıvılaştırılması için gereken soğutma işlemi, kullanılmak için yapılan geri ısıtmaya nazaran daha yüksek bir maliyete sahip olduğundan maliyetleri iyice arttırmaktadır. Bu yüzden de doğal gaz için, düşük fiyatlar eğer uzun bir süre boyunca devam ederse, ülkenin gelecekteki doğal gaz çıkarma çabalarına zarar verebilir. Tüm bu bağlamda, Amerika Birleşik Devletleri'nin diğer ülkelere kıyasla fiyat dalgalanmalarına karşı çok daha savunmasız olduğunu hatırlamakta fayda var.

Nitekim 2022'ye gelindiğinde, ülkedeki doğal gaz sektörünün bu son derece zorlu konumu, Rusya'nın Ukrayna'yı işgal etmesi ve AB'nin Rusya'nın arzını azaltmak için harekete geçmesiyle bir soluk alabilir. Bu bağlamda Rus işgalinin etkileri iki yönlüdür. İlk olarak, Rusya'nın Ukrayna ile yeniden çatışmaya başlaması, 2022'de doğal gaz fiyatlarının durgun seyrini önemli ölçüde tersine çevirerek ABD gazının ticari uygulanabilirliği iyileştirdi. İkinci olaraksa, AB karar alıcılarının Rusya'dan yaptıkları fosil yakıt ithalatlarını azaltma konusunda anlaşmaya varmasıyla (bkz. REpowerEU), önemli miktarda gaz arzının başka aktörler tarafından gerçekleştirilmesi gerekmektedir; böylece ABD, ihracatıyla AB pazarının tamamı olmasa bile, en azından önemli bir bölümünü uzun dönemde kontrol edebilecek bir imkana erişmiştir. Buna rağmen doğal gazın çıkarılması ve dönüştürülmesinde yüksek maliyetleri üstlenen ABD'nin doğal gaz sektörünün hassaslığı, uzun vadeye bakıldığında ülkenin yapabileceği toplam katkısını şekillendirecektir.

Avrupa Birliği için bir diğer önemli partner olan Katar ise dünyadaki toplamın yaklaşık %13,1'ine denk gelen 24,7 trilyon metreküplük rezervi ile dünyada üçüncü sırada yer almaktadır. Ülkenin sahip olduğu bu rezerv miktarı ve yıllık üretimi kıyaslandığında (aynı şekilde devam etmesi durumunda) Katar bu süreci yaklaşık olarak 137 yıl sürdürebilir bir konumda bulunmaktadır. Yakın zamanda açıklanan kapasite arttıma ile 2027'de yıllık ihracat hacminin 163.8 milyar metreküp olması beklenmektedir. Katar, ihracat üzerinden bakıldığında LNG üretiminde maliyeti en düşük olan ülke konumunda bulunmasıyla birlikte sahip olduğu rezervler ile de uzun dönemde AB'nin artan taleplerini karşılamada daha yüksek bir rol oynayabilir. Araştırma, ülkenin son iki yıllık verilerine bakarak AB'ye gerçekleştirmiş olduğu gaz ticaret hacmini %65.1 oranında arttırdığını gözlemlemiştir.

Potansiyel yeni boru hatları konusunda ise, kıtaya doğal gaz sağlamak için gerekli altyapının kurulması uzun süreceğinden, yeni boru hattı projeleri gereken arzın aciliyeti karşısında yetersiz kalmaktadır. Böyle bir çaba için potansiyel adayları düşündüğümüzde bu zorluk daha da şiddetlenmektedir. İlk olarak, güney rotasından gelecek herhangi bir yeni eklenme, boru hatlarının 4.000 kilometreden fazla bir mesafeyi geçmesini gerektirecektir. Ayrıca, hedeflenen kapasite miktarının AB'ye maksimum düzeyde ulaşabilmesi için Cezayir'in halihazırdaki kapasitesinin de 5 milyar metreküp arttırılması gerekmektedir.

İkincil olarak, siyasi kaygılar da oluşabilecek yeni projeleri engelleyebilir niteliktedir. Bu durum, özellikle doğudan gelecek boru hatlarını ilgilendirmekte olup Rusya'dan gelebilecek potansiyel baskı nedeniyle Azerbaycan ve Türkmenistan'ın serbestçe hareket etmesine izin vermeyebilir.

Enerji talebinin karşılanması için iklim dostu/yenilenebilir kaynakların kullanılması da AB'nin fosil yakıtlara olan talebini azaltmak için peşinden koştuğu bir yoldur. Rüzgar, güneş, gelgit, hidroelektrik ve diğer teknolojilerin kullanımı sadece enerji üretmekle kalmamakla birlikte, aynı zamanda bunu fosil yakıtların yaptığı gibi çevreye zarar vermeden gerçekleştirmektedir. Araştırma, AB'de yenilenebilir kaynaklardan elde edilen enerjinin payının, 15 yıllık süre içinde artarak, 2020'ye gelindiğinde %22,1'e ulaştığını bulmuştur.

Avrupa Birliği'nin iklim değişikliği ve yenilenebilir kaynaklarla ilgili yolculuğunun izleri 1992 yılında Birleşmiş Milletler İklim Değişikliği Çerçeve Sözleşmesi'ne kadar götürülebilir. Bu sözleşme, iklim sisteminin hızla bozulmasını önlemek için sera gazı konsantrasyonunu sabitlemeyi amaçlıyordu. 1997'deki Kyoto Protokolü'nün ardından, Avrupa Birliği 2009'da 2020 İklim ve Enerji Paketini kabul etti.

Paketin hedefleri ise, aralarında 2009/28/EC Direktifi olan üç bağlayıcı direktifte yetkilendirildi. 2009/28/EC Direktifi kapsamında, Avrupa Birliği üç ana alanda %20'lik bir değişim gerçekleştirecekti. Bunlar: emisyonlarda %20 azalma, enerji verimliliğinde %20 artış ve son olarak %20 yenilenebilir kaynaklardan gelen enerji hedefi idi. Ayrıca, AB'nin bu takip ettiği yeşil macerası devam ederek, 2014'te üye devletlerin liderleri 2030 için bir iklim ve enerji politikası çerçevesi üzerinde anlaştılar. Junker'in başkanlığı sırasında (2014-2019) oluşturulan bu çerçevede alınan

hedefler sırasıyla, 2030 yılına kadar ülkelerin emisyon oranlarının 1990 seviyelerine göre %40 oranında düşürülmesi; enerji verimliliğinde 1990 temel değerlerine göre %27'lik bir artış gerçekleştirilmesi; ve enerji tüketiminde yenilenebilir enerjinin payının en az %27 olmasıdır. 2018'e gelindiğindeyse, Direktif (AB) 2018/2001, Direktif 2009/28/EC'yi yürürlükten kaldırarak yenilenebilir enerji kaynaklarının yeni minimum payını enerji üretiminin %32'si olarak belirledi.

Bölüm 3.2.2.4.'te incelendiği gibi daha yakın tarihli REPowerEU planı, yalnızca Rusya'nın doğal gaz ithalatının azaltılmasını gündeme getirmekle kalmamış, aynı zamanda enerji karışımında yenilenebilir enerji kaynaklarının daha da artacağını da göstermiştir. Bu konuda REPowerEU planı, yenilenebilir enerji kaynaklarının 2030 yılına kadar AB'nin toplam enerji tüketiminin %45'ine ulaşmasını hedeflemektedir.

REPowerEU stratejisi aynı zamanda biyometan üretimini artırma hedefini de içermektedir. Biyometanın kullanımı, herhangi bir doğal gaz altyapısında uygulanabilirliği, gücü ve ısıtma değerleri nedeniyle doğal gazdan ayırt edilemez olduğundan, bu araştırma ayrıca REPowerEU planını daha ayrıntılı olarak ele almıştır. REPowerEU planı aracılığıyla Fit For 55 projesi yeniden gözden geçirildi ve 2030 yılına kadar 17 milyar metreküp biyometan üretimi hedefi de 35 milyar metreküpe yükseltildi. Mevcut durumda, Mart ayı itibarıyla AB'nin mevcut kapasitesi olarak 3 milyar metreküp biyometan üretimi ve 17 milyar metreküp değerinde biyogaz üretimi bulunmaktadır.

AB'nin doğal gaz konusundaki konumu ve yorumu, Avrupa Komisyonu tarafından ilke olarak onaylanan taksonomi yönetmeliğini tamamlayıcı nitelikte ve gaz ile nükleer enerjiyi içeren bir taslağın 2 Şubat 2022 tarihinde açıklığa kavuşturulmasıyla daha da netleşmiştir. Bu taslak, gaz ve nükleer enerji ile ilgili faaliyetlerin belirli koşullar altında AB sınıflandırma yönetmeliğinde yer alacağını belirtmektedir. Bilgi notuna göre, gazın faaliyet alanı, elektrik üretimi, birleşik ısı ve güç üretimi, ilçelere göre ısıtma/soğutma üretimini içermektedir. Araştırma bu yüzden önümüzdeki yıllarda doğal gaza yönelik büyük bir değişiklik beklememektedir.

Verilen alternatifler ve kapasiteleri göz önünde bulundurulduğunda, Avrupa Birliği'nin Rus doğal gazı ithalatına olan bağımlılığını azaltmak için birincil alternatif olarak daha fazla LNG ithalatı yapması gözükmekte. Bölüm 3.1.3'te de ele alındığı gibi, Avrupa Birliği LNG kapasitesini sonuna kadar kullanmamaktaydı ve bu durum

önümüzdeki süreçte AB için hala kıpırdama payı tanımakta. Araştırma sürecinde AB'ye LNG tedarik eden sevkiyatların artması ve yeni tesislerin hızla inşa edilmeye başlanması da AB'nin bu konudaki tercihini kanıtlar niteliktedir. Bu tercih, Rusya'ya olan doğal gaz bağımlılığı azaltmanın daha pahalı bir yolunu temsil ederken, tedarikçiler ve arz miktarı söz konusu olduğunda AB için en yüksek özgürlüğü ve güvenliği yaratmaktadır.

Araştırmanın 2022 yılı için yapmış olduğu teorik değerlendirmeye göre, AB'nin çalışmada belirtilen ithalat kapasitelerinin 336.3 milyar metreküp (Boru hatları + LNG) olduğunu göstermektedir. Birleşik Krallık'ın da boru hatlarını Avrupa'ya yönlendirmesi durumunda bu seviye 367.3 milyar metreküp düzeyine ulaşabilir. Ancak net talep 354.55 bcm. (400bcm. – 45.45bcm.), kalan 32 bcm depolama gereksinimi ile birleştiğinde 386.55 bcm'ye kadar çıkmaktadır. Dolayısıyla AB, karşılanamayan 50 milyar metreküplük doğal gazla Rusya'ya olan bağımlılığını tamamen azaltabilecek durumda değil. Yine de bu durum, Rusya'dan yapılan ithalatı (155bcm.) neredeyse üçte iki oranında azaltmaktadır. Eurostat'ın aylık hesaplamalarından elde edilen veriler, Rusya'nın AB'ye 46.4 milyar metreküp doğal gaz tedarik ettiğini gösteriyor ki bu durum tahminle de uyumludur. Ayrıca AB, REPowerEU tarafından öngörülen tasarruflar ve/veya elektrik karışımında doğal gaz yerine kömür kullanarak Rus gazına olan talebi daha da azaltabilir. Nitekim ihtiyaç halinde Almanya ve Polonya'nın elektrik sektöründe doğalgazı tamamen kömüre çevirmesi teorik olarak mümkün. Bu, durum AB'nin çevresel hedefleriyle çelişmesine rağmen araştırma bu hamleleri gözlemlediğini bildirmiştir. Bu sürecin kapsamlılığı ise, Eurostat'tan elde edilen en son verilere göre (2020 verileri), elektrikte tamamen alternatiflere (kömür ve/veya nükleer) geçiş, teorik olarak, toplam doğal gaz talebinde yalnızca %14.73 oranında azalma sağlayabilir. Her ülke böyle değişim için gerekli altyapıya sahip olmamakla birlikte, bu durum potansiyel yeni gaz talebinde ancak ortalama 58.92 bcmlik bir azalmaya tekabül etmektedir. Dolayısıyla, elektrik üretiminde doğal gazın bir rolü olmasına rağmen, kaynağın diğer amaçlar (ısınma) için tüketiminin daha önemli olduğunu görmekteyiz. Ayrıca, daha kirletici bir kaynak olduğu için, böyle bir çaba için önemli ölçüde kömüre güvenmek, sonuçta Birliğin çevresel hedeflerine aykırı olacaktır (bkz. Bölüm 2). Elektrik üretimi dışında fazla bir kullanım alanı olmayan nükleer enerji de bu anlamda zayıf bir alternatif olarak

kalmaktadır. Dolayısla, nükleer enerji, doğal gazdan sadece elektrik talebini azaltma konusunda rekabet edebilmektedir.

2022'den geriye dönüp bakıldığında, Avrupa Birliği, 2020 enerji üretimi hedefini yenilenebilir kaynaklardan gerçekleştirmeyi başardı. REPowerEU'nun uzun vadeli hedefleri ise, 2030 yılına kadar talepte toplam 115 ila 149 milyar metreküp azalmayı hedefliyor. Bu faktörler, hem AB'nin kendi topraklarında hem de diğer ihracatçı ülkelerde artan LNG kapasiteleriyle birleştiğinde, azalan yerli doğal gaz üretimine bakılmaksızın, resmi büyük ölçüde değiştirebilir bir durumdadır. Ayrıca, ister TAP-TANAP hatları gibi yükseltilebilir, ister Trans-Hazar veya Trans-Saharan gibi yeni inşa edilmiş olsun, potansiyel boru hatlarının genişletilmesi de, Avrupa Birliği'nin çeşitlendirme portföyü üzerinde önemli bir etkiye sahip olacaktır.

Spot ticaretten gelip gelmemesine bakılmaksızın LNG ithalatının fiyatı, daha önceki bölümlerde tartışıldığı gibi boru hattı ithalatından daha yüksek olacaktır. Bu durum ister istemez AB ekonomisine olumsuz yansıyacak olmasına rağmen, aynı zamanda ABD yerli üretiminin devam etmesi için ihtiyaç duyduğu fırsat da olabilir. İki aktörün jeopolitik alanda benzer bakış açılarını paylaşması nedeniyle, enerji alanında, özellikle doğal gaz sektöründe daha fazla işbirliği güçlü bir olasılıktır.

Kışın başlamasıyla birlikte ısınmak için gereken gaz yükü arttıkça, önümüzdeki yıllar için Rusya'ya olan bağımlılığı daha da azaltma hedefleri, bu kritik dönemde, büyük ölçüde tüketimin doğru yönetilmesine bağlı olacaktır. Doğal gazın geleceği, yalnızca ekonomik öneme sahip bir ürün olarak değil, Avrupa çapında milyonlarca insanı ısıtmak için kullanılan hayati derecede stratejik bir ürün olarak değerlendirilebileceğinden, büyük önem teşkil etmektedir.

B. THESIS PERMISSION FORM / TEZ İZİN FORMU

(Please fill out this form on computer. Double click on the boxes to fill them)

ENSTİTÜ / INSTITUTE

Fen Bilimleri Enstitüsü / Graduate School of Natural and Applied Sciences ☐

Sosyal Bilimler Enstitüsü / Graduate School of Social Sciences ☒

Uygulamalı Matematik Enstitüsü / Graduate School of Applied Mathematics ☐

Enformatik Enstitüsü / Graduate School of Informatics ☐

Deniz Bilimleri Enstitüsü / Graduate School of Marine Sciences ☐

YAZARIN / AUTHOR

Soyadı / Surname : Kalafat
Adı / Name : Kaan
Bölümü / Department : Avrupa Çalışmaları / European Studies

TEZİN ADI / TITLE OF THE THESIS (**İngilizce** / English):
ALTERNATIVES FOR THE EUROPEAN UNION'S NATURAL GAS DEPENDENCY ON RUSSIA

TEZİN TÜRÜ / DEGREE: **Yüksek Lisans** / Master ☒ **Doktora** / PhD ☐

1. **Tezin tamamı dünya çapında erişime açılacaktır. /** Release the entire work immediately for access worldwide. ☒
2. **Tez iki yıl süreyle erişime kapalı olacaktır.** / Secure the entire work for patent and/or proprietary purposes for a period of **two years. *** ☐
3. **Tez altı ay süreyle erişime kapalı olacaktır.** / Secure the entire work for period of **six months**. ***** ☐

***** *Enstitü Yönetim Kurulu kararının basılı kopyası tezle birlikte kütüphaneye teslim edilecektir. / A copy of the decision of the Institute Administrative Committee will be delivered to the library together with the printed thesis.*

Yazarın imzası / Signature ..... **Tarih** / Date .....
(Kütüphaneye teslim ettiğiniz tarih. Elle doldurulacaktır.)
(Library submission date. Please fill out by hand.)

Tezin son sayfasıdır. / This is the last page of the thesis/dissertation.