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The European Energy Crisis and the Future of the UK

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Dedication

I dedicate this humble work

To my beloved parents, for their love, guidance, and encouragement.

To all my siblings, for always being there for me.

To my respected supervisor **Dr.YOUMBAI Mohammed Yacine**, for his precious advice and efforts.

To all my friends and people who love and respect me.

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I would like to thank Allah for providing me with the strength and knowledge to conduct this research study.

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I would like to thank all my teachers who have taught me throughout my bachelor's and master's degrees.

Nevertheless, I take full responsibility for the omissions or mistakes that existed in my work.

Abstract

Currently, the European economy is facing a downturn due to an unprecedented and serious energy crisis caused by the Ukrainian war. This study attempts to investigate the short- and long-term effects of the European energy crisis on the United Kingdom. The study under investigation focuses on the key strategies that should be implemented by the EU to exit from this crisis, and what does the future of the UK look like. To answer the main research question, the Historical-Descriptive methods are adopted. The results showed that the current energy crisis is impacting Europe and the United Kingdom in particular, which exerts pressure on the European pound market. It leads to a rise in energy prices, bills, food, and low income for households. The study concludes that Europe, especially the United Kingdom, has taken many crucial decisions and measures to tackle this crisis, for instance, reducing energy consumption, lowering reliance on Russian oil and gas, and accelerating the clean energy transition.

Keywords: *Energy crisis, Europe, Ukrainian War, United Kingdom.*

List of Acronyms

BBC	British Broadcasting Corporation.
BCM	Billion Cubic Meters
CCU	Carbon Capture and Usage.
CCUS	Carbon Capture, Storage, and Utilization.
CEZ	Czech Energy Company
CPI	Consumer Prices Index.
EAC	Environmental Audit Committee.
EAS	Energy Action Scotland.
EIA	Environmental Impact Assessment.
EIB	European Investment Bank.
ENSREG	European Nuclear Safety Regulation Group.
EPF	European Peace Facility.
EPG	Energy Price Guarantee.
EU	European Union.
ESO	Energy System Operator.
GDP	Gross Domestic Product.
IEA	International Energy Agency.
LNG	Liquefied Natural Gas.
LPG	Liquefied Petroleum Gas.
MT	Million Tons.
NATO	North Atlantic Treaty Organization.
NEA	National Energy Action.
ONS	Office for National Statistics.
PPC	Public Power Corporation.
PPM	Parts Per Million.
Q2	Second Quarter.
RED	Renewable Energy Directive.
TAP	Trans Adriatic Pipeline.
TWH	Terra Watt hours.
UK	United Kingdom.
US	United States.

List of Abbreviations

COVID-19	Corona virus Disease of 2019.
EUMAM	EU Military Assistance Mission.
Euratom	European Atomic Energy Community.
EUMS	EU Military Staff.
G7	International Group of Seven Nations.
IEM	European Union's Internal Energy Market.
MIR	Interregional for Strategic Analysis.

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General Introduction

1. Background of the Study

The energy issue was extremely important for the economies of the countries and will sustain its importance in the future. Energy is not only a fundamental input to the economy but also a determining factor in the world economy in the areas of the financial, social, and geographical environment. Getting enough energy cheaply, safely, and cleanly within a certain time frame is an important signal for countries to show their level of development. Unfortunately, the European energy system is facing an unprecedented crisis not seen since the 1970s oil shocks due to many reasons, such as the COVID-19 pandemic and the invasion of Russia into Ukraine. This crisis has led to a fall in natural gas consumption in most regions. Between January and August, the demand for gas decreased by approximately 10% every year, and the industry as a whole by roughly 15% because of production cuts. Russia's gas supply for Europe (necessary for lighting, industrial operations, and heating) has been decreased this year by about 80% due to the invasion of Ukraine. Wholesale electricity and gas prices have increased 15-fold since early 2021, with a serious impact on households and businesses. The problem could get worse. So, Europe should endure higher prices, gas shortages, and a severe recession. Thereby, the European Union's search for alternative energy suppliers to reduce its reliance on Russia and accelerate the transition to renewable energy (McWilliams, Sgaravatti, Tagliapietra, & Zachmann, 2022).

2.Statement of the Problem

A massive energy crisis has hit Europe as a result of COVID-19, growing prices, climate change, and the war in Ukraine. Even though governments in Europe are putting regulations in place, including retail price caps and Support schemes for enterprises with high energy use, such measures do not provide clean solutions for two reasons. Firstly, price caps have the chance to worsen the underlying issue by increasing demand. Secondly, encouraging energy use may help people in one nation, but it would also grow consumption, resulting in increased wholesale costs within the European Union and harming people in other nations. Therefore, this study addresses the European energy crisis, the crucial decisions and policies that should be taken by the EU to exit from this crisis, and what does the future of the UK look like.

3.Research Questions

The study at hand aims to provide answers to the following questions:

1/ What are the main effects of the current energy crisis on Europe?

2/ What are the main challenges that Europe and the UK suffer from during this energy crisis?

3/What should Europe and the UK in particular do to get out of this crisis in the short and long terms?

4.Research Hypotheses

The study answers several hypotheses, such as:

1/The Russia-Ukraine war is causing an energy crisis in Europe.

2/ Europe and the UK in particular are facing many challenges, notably energy.

3/ Europe and the UK launched many schemes and plans to mitigate the energy crisis and increase the use of sustainable energy.

5.Aims of the Study

This study aims to investigate the way the European energy crisis during the Ukrainian war is impacting the UK and its future in the short and long terms.

6.Research Methodology

The current research methodology combines descriptive and historical methods. The first chapter will trace the historical background of Europe's political and economic relations to understand the current energy crisis. The second chapter will describe the UK's current economic situation, especially the current energy crisis with Russia.

7.Significance of the Study

The findings of this study show that the energy crisis is a big problem that no European nation can handle independently. Also, it aids in reducing the reliance of the EU on Russian fossil fuels, which calls for a large rise in renewable energy and faster electrification, the replacement of fossil fuels, and offering financial support to companies and households. 1 trillion euros, or around 6% of the yearly EU GDP, should be the total amount of the government's budget to avoid expensive financial expenses.

8.Structure of the Study

To better understand the issue of the energy crisis in Europe and its influence on the UK, the current dissertation consists of two cohesive theoretical chapters. The first

chapter presents a general background of the energy crisis in Europe during the Ukrainian War. It provides an overview of Europe and energy issues, types, and sources of energy in Europe. In addition, it displays the main causes of the European energy crisis, the Ukrainian war and European reactions towards Russia, an embargo of Russian oil and petroleum products, as well as providing Ukraine with economic, military, and political assistance. Also, it shows the negative consequences and the damage that Europe suffered after these sanctions as Russia its main supplier of energy, following the fragilities in the system of European energy providers. It concludes with the policies that European countries take to manage the energy crisis. Otherwise, The second chapter discusses the impact of the energy crisis on the UK. It clarifies the UK economy and its relationship with energy. As well as, identifying the main sources of UK energy, Europe especially the UK's main challenges during the energy crisis. It concludes with the plans and strategies that the UK implemented to address the energy crisis in the short and long terms.

CHAPTER ONE:

Europe's Energy Crisis During the Ukrainian War

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Introduction

Recently, a big conflict has emerged about energy resources. This chase for power is the outcome of many factors, including natural, political, economic...etc. The crisis blows up by the Russian invasion of Ukraine and the position of EU nations. As a result, the EU states boycotted the Russian fuel and apply sanctions that might have other effects on the global economic system. This chapter discusses the European Energy crisis during the Ukraine war, more specifically types and sources of energy in Europe, causes, and consequences of the current energy shock on the European economy. Along with the essential decisions and actions that the government has done to weaken Russian power against Ukraine, as well as mitigate this crisis and revive the European economy in the short and long terms.

1.1 Europe And Energy Issues

Ammer & Dandi (n.d.) stated that the EU is the third-biggest economy globally, after the China and United States. Unfortunately, the European economy nowadays is facing political, social, and economic pressures as a result of the Russia- Ukraine war.

Even though the pandemic's recovery is still not fully complete, the Russian war has affected Europe, as Gentiloni claimed: "The EU economy was on a road to rapid recovery and development until this war started. The EU economy is creating more jobs, which is bringing in more people into the labour force and lowering unemployment". ("EU Lowers Growth Forecast amid Ukraine War ", 2022, para. 2).

The EU economy is going through a difficult period due to the decrease in Russian gas supplies, which are essential for heating, industrial processes, and power. they have been decreased over than 80%. Since early 2021, the wholesale cost of gas and

electricity has grown up to 15 times, hurting both households and businesses(Zettelmeyer, Tagliapietra, Zachmann, &Heussaff ,2022). Furthermore, the high cost of power is predicted to prevent 75 million people from paying their bills, and another 100 million people are predicted to cook with wood rather than natural gas (International Energy Agency [IEA] ,2022).

According to Interregional for Strategic Analysis [MIR] (2022) firm, the EU's inability to meet gas demand resulted in a decline in industrial production, increased prices, a predicted recession in 2023, and a future slowdown in economic recovery. Also, exaggerated energy costs prevent European businesses from competing on a worldwide scale, which results in inaction, bankruptcy, or the production of goods at excessive prices. For instance, Germany warns that the continuous rise in energy prices will lead to a drop in the production of automobiles.

MIR (2022) confirmed that the finance sector was impacted by Europe's price cap policy. For instance, the United Kingdom spent 150 pounds sterling to lower consumer energy prices. Additionally, there are more political unrest and protests against the rise in energy prices in Europe, especially in France, Britain, Spain, and Germany, where workers are demanding higher pay.

Zettelmeyer et al. (2022) stressed that European countries are beginning to adopt a number of policy plans. One category of regulations tries to reduce the effects of increasing costs on customers and enterprises. These include retail price caps, managed tariffs, aid programmes for energy-intensive enterprises, and financial or capital support for energy corporations. Another group of policies aims to Stabilising and lowering wholesale prices, particularly gas prices, as well as ensure energy security, and efficiency and expand supply.

In summary, the EU's economy is negatively affected by the Russian war against Ukraine. It caused the amount of electricity to rise and gas wholesale costs, a drop in industrial production, a recession, poverty among people, negotiations, and a slowing down of the speed of economic recovery. As a result, the government takes measures to decrease costs and guarantee energy security.

1.1.2. Types And Sources Of Energy In Europe

Energy is an important component of a country's economy. The European continent uses different kinds of energy in its industries, agriculture, homes, and transportation. Some of them were imported from other countries, and others were produced there.

1.2.1. Types of Energy

A significant number of types of energy are available in Europe, for instance, petroleum, electricity, natural gas, nuclear, and renewable energy, etc...

1.2.1.1. Oil Energy

Student Energy (n.d.) defined oil, often called "petroleum" or "crude oil," as a thick, dark liquid made of hydrogen and carbon. Oil also contains small amounts of sulphur, nitrogen, and oxygen. Eurostat (2022b) clarified that a large portion of the EU's energy mix, around 34.5%, is made up of crude oil and petroleum products. The EU produced 18.7 million tonnes (Mt) of crude oil in 2020, which is its lowest level ever. Crude oil is a key source in the generation of transportation fuels and chemical products whereas its importing consumption rose to 96.20%. The total use of oil and petroleum products in EU Member

States fell to 384.0 Mote in the same year, the lowest amount ever recorded in the 31-year time period.

1.2.1.2. Electrical Energy

Based on the book entitled *More on Energy Forms of Energy: The Big 6* (n.d.), electrical energy comes from the movement of electrons. Atoms, which make up all matter, are composed of protons, neutrons, and electrons. The centre, or nucleus, of an atom, is where protons and neutrons are located. Just like the moon circulates the Earth, electrons surround the nucleus. Therefore, a current of electricity is produced when those electrons move between the atoms of matter.

Due to the COVID-19 pandemic and associated restrictions, the EU's total gross power generation in 2020 fell by 4.2%, or 2 781 TWh, compared to 2019. A high proportion of electricity generated in renewable energy facilities, at 39.0% in 2020 (Eurostat, n.d.). Meanwhile, the European Commission (2023) affirmed that renewable energy sources have increased their contribution to electricity production over the past two decades: Hydropower accounted for 87.0% of renewable electricity in 2000; by 2020, that percentage was expected to fall to 34.5%. On the other hand, the amount of electricity produced by wind climbed dramatically over this time, from 4.9% of the total supply of renewable energy in 2000 reached 36.6% in 2020. Other renewable energy sources have significant proportions in the production of electricity in 2020 were photovoltaic solar power (12.8% of all renewables), primary biomass fuels (7.6%), and biogases (5.1%).

1.2.1.3. Natural Gas Energy

Energy Information Administration [EIA] (n.d.) defined natural gas as an energy source derived from fossil fuels. Natural gas contains many different compounds (methane, carbon, and hydrogen atoms (CH₄)), small amounts of liquefied natural gas (NGL), and non-hydrocarbon gases such as carbon dioxide and water vapour.

Eurostat (2022b) claimed that natural gas is the main fuel for electricity and heat, representing 23.7% of the EU's total energy production, and was 83.6% import-dependent in 2020, with 400.6 billion cubic metres (bcm) of imports. Over the past ten years, the European Union has become more dependent on Russian natural gas, which will account for 41.1% of the entire energy supply from natural gas in 2020, making it the fuel most vulnerable to imports from Russia.

1.2.1.4. Nuclear Energy

Nuclear energy is the energy released from the operations of splitting or fusing the nuclei of atoms. The EU has 106 nuclear power reactors that are operational, and several new units are being built or planned. Presently, 13 of the EU's 27 members use nuclear energy to produce electricity. Nowadays, nuclear energy accounts for a quarter of the EU's electrical production. The European Union's member states created the European Atomic Energy Community (Euratom) in the 1950s as a response to the conventional energy crisis (European Nuclear Safety Regulators Group [ENSREG], n.d.).

The Editors of Encyclopaedia Britannica (2019) reported that Euratom was established to support the development of a nuclear energy sector across Europe. Additionally, it promotes the building of nuclear power plants and establishes a common

market for the sale of nuclear materials and equipment, but control did not cover military applications.

1.2.1.5. Renewable Energy

According to United Nations (2023), renewable energy comes from natural sources that replace themselves more quickly than they are used to consume. Some sources replenish themselves regularly, like the sun and the wind. As revealed by Eurostat (2022a), "The real consumption of renewable energy is higher than 12% because other renewable sources are included in electricity, e.g., hydropower, wind power, or solar photovoltaic".(P.10).

The energy system of the EU, renewable energy is playing an increasingly significant role. So, the Europe 2020 strategy was intended to achieve 20% of total final energy consumption from renewable sources by that year. Biomass made up the majority of renewable energy in 2019 (57.4% of total energy usage). In particular, wood is by far the most popular renewable energy source in Europe, surpassing both solar and wind power. In 2020, 23.1% of the energy consumed for heating and cooling came from this source. 37.5% of the total energy needed to create power came from renewable sources, with hydropower accounting for 33%, solar 14%, solid biofuels 8%, and other renewable sources 8%(Wikipedia Contributors, 2019).

To sum up, it is noted that the EU uses a variety of energy sources. For instance, Oil energy is used for transport fuels and the petrochemical industry; natural gas is used for heating and is mostly imported from Russia. Nuclear and renewable energy is mostly used to produce electricity.

1.2.2. Sources of Energy

Europe obtains energy from many sources, such as:

1.2.2.1. Gas Supply Market

McWilliams, Sgaravatti, Tagliapietra, & Zachmann (2022) argued that despite the European gas market being a complex system, it distributes gas very smoothly across the continent. The market continues to be flexible as Russian gas disappears from the system of supply, with LNG and alternative suppliers directly replacing a significant part of the deficit.

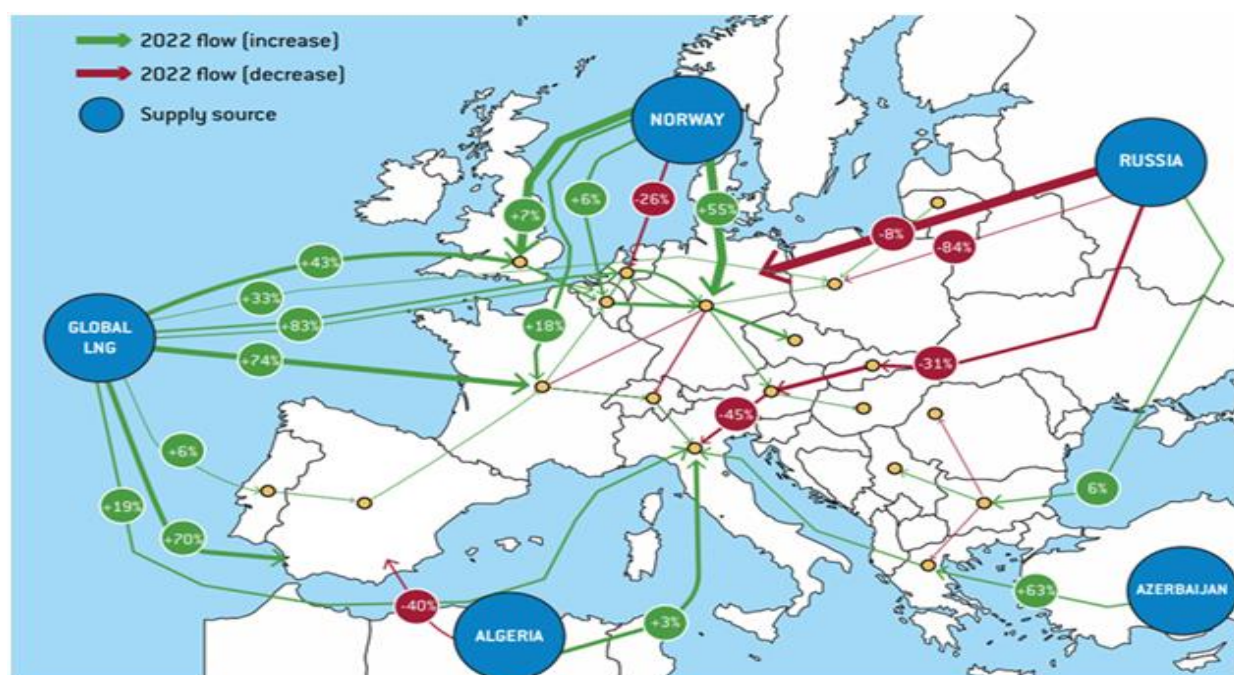


Figure1.1.

Natural gas flows in the European market, first half of 2022 vs first half of 2021 (McWilliams et al., 2022, p.3).

Erbach (2014) reported that natural gas imports made up 305 billion cubic meters (bcm), or 66% of the EU's 2013 consumption. Russia supplied 39%, Norway 33%, and North Africa (Algeria and Libya) 22% of the natural gas that the EU imported. Six EU members (Germany, Italy, France, Spain, the Netherlands, and Poland) totally depend on Russia for their natural gas support. In contrast, 71% of Russian petrol exports go to the European market, making Russia dependent on the EU as a consumer. The EU's reliance on imported gas is anticipated to rise as the domestic output of conventional gas declines. The estimated 27% increase in global energy demand through 2030 will also affect the energy security of Europe.

Erbach (2014) affirmed that a network of pipelines carrying 530 billion cubic meters of gas each year connects Europe to its gas sources, with alternative routes passing via Belarus and under the Baltic Sea. In addition to pipelines, Europe has 19 LNG import terminals, with more being built. The EU's LNG imports decreased to 37.4 billion cubic meters (bcm) in 2013 from 76.5 bcm in 2011 due to increased LNG demand from Asia. Now, Europe can import LNG to meet more than a third of its entire gas demand.

European Commission (n.d.-b) reported that in the second quarter of 2021, the EU's net gas imports increased by 7% (6.2 bcm) due to rising gas consumption and declining domestic production. In the second quarter of 2021, there was a significant difference in net imports across the EU. Net imports increased in Portugal by 34% and Hungary by 38% year over year. While net gas imports declined over than 20% in Denmark, the Netherlands, and Austria, while there are increasing by more than 20% in Greece, Luxembourg, and Slovenia. Also, Spain saw a 23% increase in net gas imports, Belgium had a 19% increase, Germany had a 16% increase, Poland had a 15% increase, and Italy had a 10% increase. Germany (21 bcm), Italy (19 bcm), France (11 bcm), Spain (8 bcm), the Netherlands, and Poland (each one

less than 5 bcm) were the biggest importers in the EU. These six nations collectively accounted for 75% of total EU net gas imports in Q2 2021, up from 84.5 bcm in 2020.

1.2.2.2. Important Gas Resources for the EU

Europe is relying on different countries to import energy, which include:

1.2.2.2.1. Russia

Based on European Commission(n.d.-b), in 2020, the annual growth in Russian pipeline gas imports was 5%. Russia continued to be the EU's top gas supplier, it contributed 42%of all imports of gas from outside the EU , up from 41% during the 2020 second quarter . The main source of supply was the Russian pipeline (44%), followed by LNG regasification stations in Norway (both between 21 and 22%), pipeline gas from Algeria (11%), The Trans Adriatic Pipeline (TAP) (1.5%) and Libya (1%).

1.2.2.2.2. Algeria

According to US (EIA) estimations, the third-largest shale gas reserves in the world are located in Algeria. Also, it already has pipeline connections to Spain and Italy. So, Algeria could double its gas production in the next two decades, depending on the results of the exploration by many energy companies (Erbach, 2014). Also, pipeline gas imports from Algeria notably rose in the second quarter of 2021, by 223%, leading to increasing of imports from outside the EU by 7% since Q2 2020 (European Commission, n.d.-b).

A projected 870 km natural gas pipeline called the Trans Adriatic Pipeline (TAP) would link Greece and Italy by way of Albania and the Adriatic Sea. It offers capacity to shippers to transport gas in a secure, dependable, and effective manner (“About TAP,” 2023). As explained by Bechev (2020), TAP helps diversify supply away from Russia and

strengthens Azerbaijan's position on European markets by delivering 10 billion cubic metres of natural gas annually to consumers in the EU and the Western Balkans.

Veliyev (2022) argued that approximately 20 billion cubic metres of gas can be supplied by Azerbaijan. About one-third of the total amount of Azerbaijani gas exports were shipped to EU nations. According to data from the Azerbaijani government, EU authorities, and Eurostat, 8 billion cubic metres of gas were exported by Azerbaijan to the EU in 2021.

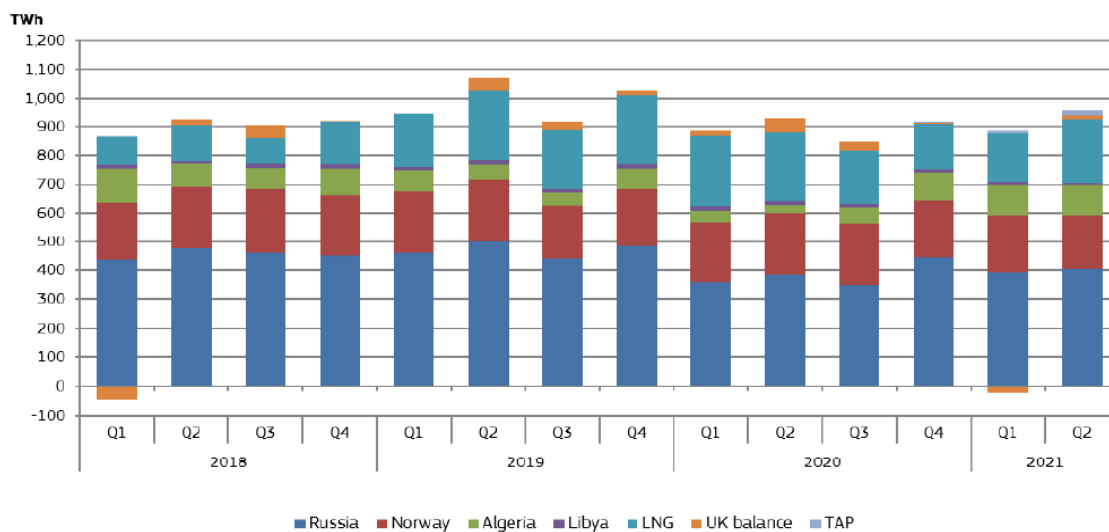


Figure1.2.

EU imports of natural gas by source, 2018-2021(European Commission., n.d.b.p. 11).

In brief, the EU depends on numerous nations to import gas. Russia is currently the main gas supplier, accounting for 42% of the gas supply, followed by Algeria (11%). Then, Azerbaijan through the Trans Adriatic Pipeline (TAP) made the EU import 8 billion cubic metres of gas in 2021.

1.3. Causes Of The Energy Crisis In Europe

The European energy crisis is a complex issue that has been primarily caused by a combination of factors as follows:

1.3.1. COVID-19 Pandemic

Verwey & Monks (2021) Economists at the European Commission stated that a historically significant economic slump was brought on by the COVID-19 pandemic in 2020, with real GDP in the EU dropping by 6.1%, more than it did during the global financial crisis. It resulted in growing deficits, government, and private debt ratios in all member states. Over the following ten years, it is anticipated that debt ratios will continue to be higher than before the pandemic.

Ammer & Dandi (n.d.) stressed that COVID-19 led to an economic downturn due to lockdown measures taken by countries to limit its spread. It caused a declining demand for primary energy sources, with a 4.5% average. For instance, the use of natural gas has fallen by 1.8%, petroleum by 9.7%, and coal by 4.2%. Besides, maintenance operations for natural gas fields decreased and investments declined during the pandemic, bringing natural gas prices to a record high of more than 200 dollars per barrel, a price that is more than eight times higher compared to previous years.

1.3.2. Russia-Ukraine War

The majority of the energy supplied to Europe comes from Russia, 41% of the natural gas, 27% of the oil, and 46% of the coal. The invasion of Ukraine led to restrictions on supplies to Europe. Additionally, energy prices have risen and are still very unstable. As Besson, (2022) mentioned:

Uncertainties about supplies from Europe's main supplier Russia increasing market instability, boosting volatility and prices even further. One thing is certain: the outlook for the medium term indicates that energy prices will remain higher than the recent average for quite a while. (para.3).

Russian gas supply has decreased by 89% from a year ago ever since the Nord Stream 1 operation was stopped by Gazprom. Energy costs are rising due to this decline in supply and the heavy reliance of European nations on Russian gas. It recorded that gas prices in Europe have surged tenfold compared to their typical past values. As a result, Europe has recognized the importance of diversifying its energy sources to reduce its reliance(Malaysia ,2022).

1.3.3. Severe Atmosphere

Malaysia (2022) highlighted that due to the extremely cold winter at the beginning of 2022, households in Europe required extra energy to heat their homes. Energy supply chains were further hampered by the difficulty of shipping LNG to Europe through energy infrastructure due to the extreme cold. Additionally, nations that depend heavily on wind energy, like Germany and the Netherlands, had poor wind conditions. Gas and coal demand increased as a result of the insufficient energy produced by wind turbines. As Ammer & Dandi (2021)reported:

The cold weather in winter creates huge pressure on energy-consuming countries, especially European countries that rely heavily on natural gas for power generation. Also, the long and very cold winter has led to the depletion of natural gas stocks in Europe, which reached 30% in March 2021. (p.2-3).

To conclude, a variety of causes have contributed to the current European energy shock. First, the COVID-19 pandemic, increased all Member States' deficit and debt levels while lowering demand for main energy sources. Second, the invasion of Ukraine by Russia created inflation. Finally, extreme weather conditions increased the amount of energy needed to heat homes.

1.4. Ukrainian War And European Reactions

Russia has launched a damaging war against Ukraine, which has bad consequences for global countries, especially Europe. How does Europe deal with this war?

1.4.1. Invasion of Ukraine

The beginnings of this conflict started in 2013, when Moscow convinced the pro-Russian leader of Ukraine to break off on the agreement with the European Union. This caused protests that eventually brought him down and resulted in Russia annexing Crimea and launching a land grab in the east (Kirby,2023). Following the annexation of the Crimean peninsula in 2014, Putin wants to revive what he calls the “Russian world”. He apparently thought to himself, Why not go further? (Nye, 2022).

IEA (2020) announced that the difficulties in the energy industry further worsened after Russia invaded Ukraine in February 2022. One in five of the energy units consumed in Europe in 2021 will be sourced from Russia, a significant provider of fossil fuels to the continent. Although infrastructure was developed to diversify import sources, Russian import flows remained high, and between 2015 and 2020, natural gas consumption rose from 30% to 40%.

1.4.2. European Reactions

Europe has taken strict laws and measures against Russia to safeguard the energy sector, including:

1.4.2.1. EU Embargo Of Russian Oil And Petroleum Products

The European Union has implemented a strict ban on Russian petroleum products including crude oil, along with preventing Russian oil exports without shipping insurance. However, achieving the goal of eliminating Russian oil from the market and decreasing Russian export income without adversely affecting consumers in Europe and elsewhere may prove challenging (Cahill, 2022).

1.4.2.1.1. German Embargo

According to Wehrmann (2022), during the first half of 2022, natural gas constituted approximately 27 percent of Germany's total energy consumption. Following the invasion, Germany swiftly reduced its reliance on Russian gas, decreasing the share from around 55 percent in February to approximately 35 percent in May 2022. President Ursula von der Leyen said: "We must become independent from Russian oil, coal, and gas. We simply cannot rely on a supplier who explicitly threatens us" (Baev et al., 2022, p.2).

Germany announced on February 22, 2022, that it would stop certification of the Nord Stream2 petrol pipeline, which runs parallel to the Nord Stream1 instead of doubling its capacity (Baev et al., 2022). Keating (2022) mentioned that the German government had already launched plans to significantly reduce Russian oil imports before the embargo became public. Many German companies had already decided to end contracts with Russian producers and were actively seeking alternative suppliers. However, a major challenge lies in

transporting oil from the western to the eastern part of Germany, as there are no pipeline connections. Alternative means such as boats, roads, and railways may be utilized for transportation.

1.4.2.1.2. French Embargo

Alhurra's (2022) newspaper article reported that France does not rely heavily on Russian gas and oil. Only 25% of France's gas imports come from Russia, with Norway being the country's largest gas supplier (35%). So, the French government strongly supports the ban on Russian oil imports. Finance Minister Bruno Le Maire stated to CNN France that the French government is ready to go ahead and will implement the Russian oil embargo. Besides, it strongly decides that the problem of Russian oil sanctions will be the main topic of discussion and action moving forward.

Ranjan (2022) stressed that to exert pressure on the Russian Federation amid its conflict with Ukraine, France has decided to initiate action aimed at convincing the European Union to implement a restriction on Russian oil. Bruno Le Maire, the Economy Minister of France, expressed that France is actively seeking to gain the approval of EU members to enforce an embargo on the supply of Russian oil. The objective is to weaken Russia's capacity to finance its on-going military intervention in Ukraine.

1.4.2.1.3. UK Embargo

On December 5th, the UK will apply a ban that includes the following restrictions: prohibition of importing oil and petroleum products from Russia or those dispatched from Russia to the UK. In addition, prohibition of directly or indirectly offer technical aid, financial support, money or scheduling for the import, purchase, supply, and delivery of oil and oil-related goods from Russia to the UK (Melia, 2022).

According to Mawer &Maag (2022), the UK has implemented regulations banning the purchase, transport, and import of Russian crude oil under specific HS codes, along with restrictions on providing financial and technical services related to the import of Russian oil. However, there is an exception called the Oil Price Cap, which permits the UK service providers to supply Russian oil to developing countries, provided that the price remains within a specified limit.

1.4.2.1.4. Other States' Attitude on the Embargo

Alhurra (2022) revealed that several EU members, including Austria, Spain, and the Netherlands, oppose the EU's restrictions on oil and petroleum products in Russia because of their worries about the negative economic consequences of this prohibition.

Sanctions against Russian gas and oil imports were not accepted by Austria. On April 4, Finance Minister Magnus Brunner stated if the sanctions affected one of the EU countries more than Russia, it would not be the best solution. On the other side, Spain is also not desire to impose sanctions on Russian gas because it will suffer from higher gas prices and find alternatives to Russian fossil fuels. Since Prime Minister Pedro Sanchez supported Morocco in its war with Algeria over the Western Sahara, Spain is in conflict with Algeria, one of its primary gas providers (Alhurra,2022).

The Dutch newspaper Financiele Dagblad stated that even though the House of Representatives recommended tighter restrictions on Russian energy imports, this would have a catastrophic impact on the Netherlands' economy. The country may experience increased transportation expenses if it stops importing from Russia due to its small size and its amount more than 15% reliance on Russian gas. Dutch Prime Minister Mark Rutte confirmed that the Netherlands cannot stop all fossil fuel imports from Russia (Alhurra,2022).

To conclude, the majority of EU nations support the embargo on Russian oil and petroleum products as a means of weakening the Russian economy and putting an end to the conflict with Ukraine. While some other EU countries were unable to accept this ban because their economies would be more severely impacted than Russia's.

1.4.2.2. EU Measures Against The Russian –Ukraine War

In reaction to Russia's invasion of Ukraine, the EU took a variety of measures, including:

1.4.2.2.1. Military Measures

According to European Council (2023), the EU supports the Ukrainian Armed Forces by providing equipment and supplies that are not lethal. Firstly, the Council adopted assistance measures under the European Peace Facility (EPF) to give military aid to Ukraine, including a seventh bundle costing €500 million and a new €45 million measure supporting EU Military Assistance Mission (EUMAM) Ukraine's training efforts.

Bilquin & Immenkamp(2022) added a clearing house has been established by the EU Military Staff (EUMS) to manage supply and demand. Ukraine sends requests to the clearing house, which hosts conferences with all partners and members to discuss the equipment required, offers, priority analyses, and military assessments of the situation. Member States then decide what they will provide, and each member state delivers its equipment and weapons. For example, Germany offered 1000 anti-tank weapons and 500 missiles, France donated missiles, ammunition, safety gear, and fuel, and Hungary gave a package of humanitarian relief that included food and fuel.. etc.

1.4.2.2.2. Political Measures

The EU's attitude toward Russia's invasion of Ukraine was aggressively against such an illegal, ruined war. The High Representative Josep Borrell said that the EU demanded President Putin stop all attacks in Ukraine and remove any troops and weaponry because Russia will bear complete responsibility for the harm and losses that will bring about (European Commission, 2023).

International law has been broken by Russia's military aggression against Ukraine. Therefore, the EU and its transatlantic allies are working together to come to a peaceful agreement to this problem. The European Commission has imposed ten packages, including new financial and trade punishments, export restrictions, enforcement and anti-circumvention measures, and a new reporting requirement on assets owned by the Russian Central Bank. These sanctions aimed to hurt Russia's ability to fund its fight with Ukraine, burdens on Russia's elites, and destroy Russia's economic base (European Commission, 2023). Besides, the High Representative Josep Borrell confirmed that the EU will continue to give the Ukrainian people all the assistance required to put an end to this senseless conflict (European Union External Action, 2022).

1.4.2.2.3. Economic Measures

In response to the war between Russia and Ukraine, the EU implements economic actions like:

1.4.2.2.3.1. Financial Sanctions

European Council (2023) suggested that the financial sanction of the EU against Russia is confirmed by the EU's second package. It set additional restriction which prevents

Russian access to capital markets, restricts financial inflows from Russia to the EU, and forbids the listing of Russian state-owned companies on EU exchanges. Significant Russian institutions have been blocked off from the global financial communications system Swift. (an international financial system that enables cross-border money transfers and sends over 40 million messages every day as trillions of dollars are exchanged between firms and governments), postponing the payment for Russian gas and oil. Due to a threat from Western allies, Russia created the System for Transfer of Financial Messages SPFS as a substitute for Swift.

1.4.2.2.3.2. Energy Sanctions

According to European Council(2023), the EU will impose limitations on the imports of coal and other solid fossil fuels from Russia starting in August 2022, worth € 8 billion annually, and will forbid the sale, supply, transfer, or export to Russia of specific products and technologies used in oil refining.

BBC News (2022) revealed that the EU has made its plan that is urgently necessary to lessen reliance on energy supplies from Russia. On May 18, 2022, the Commission adopted its REPowerEU Plan in an attempt to reduce reliance on Russian fossil resources and address the problem of climate change. The EU and G7 agreed upon a maximum price of \$60 per barrel for Russian crude oil in December 2022. They reminded importers that if they pay more, insurers will refuse to cover oil shipments. The International Energy Agency reported that Russia is currently exporting 8.3 million barrels of oil per day, which is the highest level since April 2020. China and India are the two biggest importers. According to the International Monetary Fund, Russia's GDP may rise by 0.7% in 2023.

1.4.2.2.3.3. Transport Sanctions

The EU adopted a prohibition on the export of products and technology related to the aviation and space industries, as well as it launched that, any aircraft owned, chartered, or otherwise controlled by a Russian legal or natural person will no longer be permitted to land in, or fly over the region of the EU (European Commission, 2022). In addition, the provisions for visa facilitation will no longer apply to diplomats, politicians, and business people. This restriction will worsen the country's economy and connectivity, as three-quarters of Russia's existing commercial aviation fleet is made in the EU, the US, and Canada (European Council, 2023).

Overall, the EU launched a variety of restrictions, including economic, political, and military ones, to limit Russia's imperial ambitions, destroy its economic base, and finish its war in Ukraine. These sanctions have hurt Russia's economy, minimizing income and denying Moscow essential technology. However, trade with other nations, particularly China and India supported the economy and mitigated Western sanctions. It is obvious that the EU and the West as a whole have not yet succeeded in achieving stopping the war against Ukraine, and the Russian economy has not collapsed as predicted.

1.5. The Impacts Of The Ukrainian War On Europe

The Ukrainian war leads to many changes in European policies and causes many economic consequences, as follows:

1.5.1. Diversifying Gas Suppliers to Europe

European Investment Bank [EIB] (2022) reported that the European strategy has replaced Russian gas pipeline supplies with ship-imported LNG from other states,

particularly China, India, Japan, and South Korea, leading to high prices and limited gas supply. EU member states bought 1,098 million cubic meters of petrol from Russia in 2022, a third less than in 2021. Europe imported record amounts of liquefied petroleum gas (LPG) from January to May 2022, 66% more than the yearly average in 2021. This gas was shipped to northwest Europe, where it was used to restock stores and directly displace consumer purchases of Russian gas.

Baev et al. (2022) claimed that Europe has been able to import higher quantities of LNG from other countries by increasing its market share for LNG, with 74% of US exports going to Europe in 2022. A new LNG production capacity has been developed in Africa as a result of the European "rush for LNG." For instance, six upcoming natural gas sources in six African nations (Ethiopia, Tanzania, Mozambique, South Africa, Senegal, and Mauritania) were stimulated by European demand. These hubs result in the development of new fossil fuel production and jeopardize efforts to reduce carbon emissions worldwide.

In reaction to Moscow's invasion of Ukraine, the European Union is working on shifting Europe's energy supply away from Russian gas. The EU and Azerbaijan agreed on a memorandum of agreement in July that calls for doubling the amount of Azeri gas imports to 20 billion cubic metres annually by 2027 ("European Countries, Azerbaijan Agree to Boost Gas Transfers", 2023).

1.5.2. More Financial Spending

EIB (2022) suggested that it is anticipated that the budgets of EU member states would suffer. Spending may increase when nations take in migrants, implement redistributive policies to assist households in coping with energy cost increases and improve military spending because the majority of NATO members in the European Union fail to meet the 2%

GDP target. Spending will need to be significantly enhanced to fulfil the targets, not just for countries in Western Europe like Germany and Spain but also for countries in Eastern Europe like the Czech Republic and Slovenia. Therefore, the government has applied many techniques, including combinations of lump-sum payments, tax reductions, energy subsidies, and price increase caps, to reduce energy prices and protect people and businesses from the direct impact of rising prices. These measures are anticipated to impact budgets in EU member states.

1.5.3 Further Negative Effects on Europe's Economy

EIB (2022) affirmed that since the war in Ukraine began, economic growth predictions for Europe have been lowered and inflation expectations have been raised. The most recent predictions show that real gross domestic product (GDP) growth in the EU could fall well below 3% in 2022, down by more than 1.3 % compared to predictions made before the war. This war makes companies more vulnerable. It decreased exports, increased energy prices that reduce profit, and difficulty finding funding as banks avoid risk.

According to simulations at the company level performed by the European Investment Bank, the percentage of firms losing money will rise from 8% to 15% in a year and the percentage of firms in danger of default would increase from 10% to 17% during the same period. Finally, there are other sectors affected such as chemicals, medicines, transportation, food, and agriculture (EIB, 2022).

In general, the Russia-Ukraine war is putting pressure on the European energy sector. The EU's decision to reduce dependency on Russia's supply, as well as replace Russian gas pipeline supplies with ship-imported liquefied natural gas (LNG) from other states like the US, China, Azerbaijan and Africa. As a result, Europe now suffers from high

energy costs, limited gas supply, and increased fiscal spending due to cutting price cap policies to help people and companies.

1.6. Fragilities In the System Of European Energy Provider

The EU experienced a severe energy and gas crisis in 2021 due to the end of COVID-19 restrictions and Gazprom's supply restrictions, leading to economic weakness ((European Commission, n.d.-a).

McWilliams et al. (2022) said:

Even though the energy market in Europe has been gradually liberalized, a European internal market for electricity remains uncompleted. Local players still dominate their domestic markets. Moreover, the degree of market concentration varies greatly, and instances of high market concentration remain: Electricity of France retains a market share of more than 70 % in France, and in many smaller countries, individual players have similar levels of dominance (for example, CEZ has about a 70 % share of generation and distribution in the Czech Republic, and PPC has around 66 % of the retail market in Greece). (p.9).

European energy companies depend on one another. European energy firms to satisfy customer demand and manage the risks brought on by unstable supply, demand, and prices. The danger of Gazprom not providing the stated quantities and the risk of customers wanting bigger volumes of energy at previously agreed-upon reduced prices have all put tremendous pressure on the risk management of energy firms (McWilliams et al., 2022).

As explained by Claesson (2021), the vulnerability of the European energy system is becoming more apparent as a result of continued coal and nuclear closures, a constricting carbon market, and recent rises in gas and electricity prices. This has made Europe more dependent on natural gas, of which 60% is imported, which has led to worries about the whole system's vulnerability. However, natural gas prices exceed coal prices due to a constricting European carbon market, which encourages the production of coal, raising carbon prices and perhaps having an impact on the entire European economy. Europe is finding it more and more challenging to balance the stricter environmental regulations with its growing reliance on imported gas.

Overall, the fragility of the European energy system is becoming more obvious due to Gazprom's failure to deliver on its commitments, consumers' demands for bigger volumes at cheaper rates, as well as continued closures of coal and nuclear plants, a constricting carbon market, and rising gas and electricity prices.

1.7. How European Countries Managed The Energy Crisis

When the EU experienced an energy crisis, the European Commission took immediate measures to cut energy demand, enhance energy efficiency, and raise energy savings. These steps include:

1.7.1. Diversifying Energy Sources

Damen (2023) highlighted that the European Commission released the first communication on the REPower EU plan on March 8, 2022, intending to lower the EU's reliance on Russian energy sources. A second version of the plan was released by the Commission on May 18, 2022, and it called for a threefold strategy to make up for Russian energy sources, including energy conservation, supply diversification, and accelerated

renewable energy use. Also, the EU has also signed new LNG and pipeline gas contracts with several other countries to decrease its reliance on a single major supplier. These efforts have improved energy relations with Israel, Egypt, Algeria, Azerbaijan, and the US, however, they may result in supply problems in the future caused by political or economic unrest.

Ciucci (2022) mentioned that European countries have established interconnections and developed cross-border energy trade mechanisms to enhance energy security and improve resource utilization. Initiatives like the European Union's Internal Energy Market (IEM) have facilitated the exchange of electricity between countries, allowing them to tap into neighbouring resources and balance supply and demand. This integration reduces dependency on a single energy source and increases overall resilience.

1.7.2. Energy Demand Reduction

Widuto (2022) stressed that the European Commission has suggested a decline in gas and electricity consumption as a short-term solution for mitigating the energy crisis. So, the Commission announced on July 20, 2022, the European Gas Demand Reduction Plan, which calls for a targeted reduction in gas for heating and cooling. Additionally, it emphasizes quickening the development of LNG infrastructure. This strategy would enable 45 bcm of gas to be saved across the EU over eight months i.e. improve energy savings while preparing for potential disruptions in the Russian gas supply. The Commission also presented a proposal on September 20, 2022, for a Council regulation to tackle high energy prices that outlined two targets for reducing electricity demand: a 10% decrease in total monthly gross electricity consumption and an obligation that the Member States minimize electricity consumption by at least 5%. These regulations would apply from December 1, 2022, to March 31, 2023.

Widuto (2022) added that the Member States may select additional measures, such as the integration of Smart Grids to allow for the efficient distribution of electricity and enable consumers to monitor and adjust their energy consumption as well as Energy Storage Technologies, such as batteries and pumped hydro storage, to help store excess energy produced by renewable sources and guarantee a steady power supply.

1.7.3. Renewable Energy Transition

De Pous, Patuleia, Brown, & Rosslowe (n.d.) reported that it is high time for EU energy ministers to emphasize the benefits of clean energy. As well as, accelerating the use of inexpensive renewable energy to lessen Europe's dependence on expensive fossil fuels, and having positive effects on the environment. In May 2022 the European Commission declared The REPowerEU plan to raise the Renewable Energy Directive (RED) target from 40% to 45%, sets goals for energy efficiency, achieved the gas price cap, and encouraging investment now rather than later. For instance, the amount of electricity generated by wind and solar energy saved €99 billion of imported gas.

Damen (2023) stated that the EU established the EU Green Deal, intending to stabilize the European economy by 2050 and lower net greenhouse gas emissions by at least 55% by 2030. According to Eurostat, renewable energy accounted for 22.1% of EU energy consumption in 2020. The EU solar energy strategy of May 2022 welcomes the 82% decline in costs for photovoltaic solar energy during the last ten years. Countries like Germany, Denmark, and Spain have made significant investments in wind and solar power, leading to substantial increases in renewable energy capacity.

To sum up, the European government has adopted significant policies that pair short-term reductions with long-term solutions to address the energy crisis. It reduces

dependence on Russia and shifts imports to other countries. It also launched the European Gas Demand Reduction Plan and proposal to minimize gas and electricity consumption. It also sets new plans like the REPowerEU and the EU Green Deal to decrease greenhouse gas emissions, invest in renewable energy in a way that preserves the environment and consumers, and decrease the demand for electricity and gas.

Conclusion

As a conclusion for this chapter, the European economy is among the biggest developed economies in the world, relying on a variety of energy types. However, Europe is struggling with a severe energy shock caused by the COVID-19 pandemic, extreme weather conditions, and Russia's invasion of Ukraine. The EU and its allies have imposed a range of sanctions against Russia to reduce its power, destroy its economy, and stop the war and its catastrophic effects on the energy sector, but trade with other countries, especially China and India, has helped the economy and diminished the impact of Western sanctions. As a result, the Russian war has had negative impacts on the EU economy, leading to an increase in electricity and gas wholesale prices, a recession, and a sluggish rate of economic recovery. Additionally, high energy costs have made it impossible for European businesses to compete internationally, leading to inaction, financial ruin, or the production of goods at ridiculously high prices. Consequently, the European Union has implemented considerable policies to solve the energy crisis that combine quick reductions with long-term remedies, such as importing from other nations instead of Russia, introducing the EU Green Deal strategy, and the REPowerEU plan to achieve sustainable energy use.

CHAPTER TWO:

The Impact of the Energy Crisis on the UK

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Introduction

The UK is one of the most seriously impacted countries in Europe by the present energy crisis due to its excessive reliance on gas for heating and restrictions on Russian energy imports, which were the main sources of supply. This chapter is concerned with discussing the impact of the energy crisis on the UK economy as well as the main sources of energy in the UK. Additionally, it sheds light on the challenges that Europe and the UK in particular are facing during the energy crisis. Finally, it deals with the short- and long-term solutions to tackle this crisis and transition into a sustainable energy future.

2.1. UK Economy And Its Relation To Energy Crisis

The UK is still recovering from the shock of the COVID lockdowns, and Russia's invasion of Ukraine has begun to harm its economy. It is the only G7 nation whose economy is now less than it was before the COVID epidemic ("The UK's Economic Crisis Explained in Seven Charts," 2023).

Energy costs in the UK are higher than those in other European nations, and Britain has experienced higher price increases than other European nations because of rising demand following the easing of the COVID-19 pandemic restrictions and the Ukraine War. As a result, the Office for National Statistics said that natural gas prices in the UK increased by about 96%, while electricity prices increased by 54%, and the UK expects yearly consumer price inflation for gas and electricity to reach 80% (Cooban,2022).

This crisis has increased the pressure on the pound, and it may quickly bring the pound's value below the parity of £1 to \$1 (Pettinger, 2022). The pound dropped to a record low against the U.S. on September 26 by reaching a low of \$1.038. This will raise inflationary

pressures in the future, and UK households' living standards will decline (Schomberg & Bruce, 2022).

As asserted by Dixon (2022), the crisis increased the government's spending to supply education, health, and other services, and decreased the use of fossil fuels in the impacted nations, including the UK. Pettinger (2022) stressed that the UK economy is facing its worst recession due to this crisis. Even though the government has provided a fiscal boost, it is expected to be countered by increasing interest rates, rising energy costs (which are still rising by 25% despite the pricey price cap), dropping home values, low confidence, declining real wages, and creating a worse trade-off with the government.

In the third quarter of 2022 (July to September), the UK economy fell by 0.3%. As the Bank of England said that GDP growth is "slowing," and the most recent gas price increases, have caused another major decline in the prospects for activity in the UK and Europe ("How Will Recession Affect the UK?" 2022).

Households' lives have been affected negatively by the current energy crisis. Consumers are struggling to pay rising rents, mortgages, food, and energy prices. According to the Office for National Statistics (ONS), more than 90% of people have seen an increase in their cost of living, they are finding it challenging to pay their bills. The biggest ever recorded reduction in living standards is anticipated for the next year as family incomes fall by 4.3% ("The UK's Economic Crisis Explained in Seven Charts," 2023). The UK National Statistics Office reported that about 13% of households in England are fuel-poor. This means that if they adequately heat and light their home, high energy bills would cause them to fall into poverty ("Some Key Facts to Know about Energy in the UK", n.d.).

To conclude, the UK economy is badly affected by the energy shock. It is noticed that there are high energy costs, a decline in the pound, an impending recession, and widespread poverty among families.

2.2. Sources Of Energy In The UK

The UK has many energy sources that it relies on to power its economy and meet the energy needs of its population. These sources of energy include:

2.2.1. Renewable Energy

Based on National Grid (2022), the UK hopes to achieve net zero by 2050 by switching to 100% renewable energy generation. The UK just began using renewable energy sources for electricity production in 2020, with a mix of hydroelectric, solar, wind, and biofuel sources providing 43% of the UK's energy. These sources rely on the natural power of the sun, weather patterns, waterways, tides, and organic matter to produce electricity.

National Grid (2022) revealed that in 2022, wind power produced over 20GW of electricity, biomass energy contributed 5.2% to the renewable mix, and Solar power, and hydropower contributed 1.8% to the renewable mix. It is anticipated that the UK's renewable capacity will rise significantly over the next 10 years. In February 2022, the UK had its lowest carbon intensity month ever recorded with an average of 126 grammes of CO₂ per kWh.

2.2.2.Nuclear Energy

In the 1950s, the first industrial-scale nuclear power plant in the world was located in the UK, and it currently has 15 active nuclear reactors, accounting for just under 20% of the country's electricity production. In the past few years, nuclear power has

prevented the release of 22.7 million metric tons of CO₂ emissions in the UK. Currently, the UK intends to start operating new nuclear plants by 2025 to compensate for the anticipated loss in nuclear generation. This is important because of the nation's policy of gradually eliminating coal-fired production without CO₂ and achieving zero net emissions by 2050 (Market Intelligence, 2020).

2.2.3. Imported Energy

Aizarani (2023) highlighted that although the UK was once able to meet its domestic energy needs on its own, its reliance on imports has grown over the last few decades. It imports some of its energy from other countries, such as natural gas from Norway due to the depletion of oil and gas fields on the continental shelf, as well as the decision of the government to phase out coal.

In the period between 1990 and 2019, net electricity imports nearly doubled, amounting to 1.8 million metric tons of oil equivalent, because of the Nemo Link to Belgium which helped to import cheaper electricity. Additionally, electricity imports could reach 6 million metric tons of oil by 2030. The reliance rate had now decreased to about 35%, largely due to increased wind power capacity expansions and a decrease in primary energy use (Aizarani, 2023).

2.2.4. Fossil Fuels

Environmental Audit Committee [EAC] (2023) reported that the UK relies on energy to power its businesses and industries, generate electricity, heat its homes, and operate its transport system. Currently, 78% of this energy comes from fossil fuels including coal, gas, and oil. These high-carbon fuels are employed in combustion engines, boilers, and power plants, which contribute to the majority of the UK's territorial greenhouse gas emissions.

The UK's reliance on oil and gas has resulted in the largest global spike in the price of fossil fuels since the 1970s, and they kept up the increase as Russia cut off the supply of gas to continental Europe.

Overall, the UK uses diverse energy sources, such as renewable energy, nuclear energy, imported energy, ...etc. It has historically been dominated by fossil fuels. Recently, it establishes challenging goals to lower greenhouse gas emissions and expand the usage of clean energy sources in the coming years.

2.3. Europe Especially UK Main Challenges During Energy Crisis

The current energy crisis presents several formidable obstacles, linked with political, economic, and social issues. What obstacles are Europe and the UK in particular facing?

2.3.1. Challenges in Front of Europe

According to Surwillo (2023), the EU might improve its supply security over the long term and address the developing energy-climate issue by phasing out fossil fuels, particularly those imported from Russia, and accelerating the transition to a low-carbon economy. For European consumers, this task will be expensive. There are no simple solutions or universally applicable measures because each member state must address the issues within the boundaries of its own unique energy mix and economic position.

Surwillo (2023) confirmed that the EU requires other sources of gas that are more expensive and difficult to obtain than Russian gas due to market and infrastructure restrictions. The main replacement option is liquefied natural gas, which requires the construction of pricey LNG terminals and long-term contracts with major suppliers such as

the US, Australia, and Qatar. The cost of obtaining LNG on the international market has more than doubled since Russia invaded Ukraine in February 2022.

2.3.2. Challenges in Front of the UK

The UK is facing numerous obstacles including:

2.3.2.1. Inflation

The rate of price growth over an extended period is known as inflation, for example, the overall increase in prices or the rise in the cost of living in a nation (Oner, n.d.). global inflation has increased as a result of high energy prices. UK energy prices are linked to international markets. The increase in energy costs over the past year has been the main cause of inflation in the UK. The availability of gas in Europe has worsened since Putin started weaponizing gas supplies in the spring. The UK prices of LNG have also climbed as a result of competition between Europe and Asia to get supplies before the winter (Chancellor of the Exchequer, 2022).

According to Curiosity Stream (2022), the Bank of England forecast CPI inflation will continue to grow and probably reach an astounding 13% in the fourth quarter of this year, from September to December. Energy costs are the primary cause of this worse inflation. Throughout the bank's monetary policy report, the bank emphasizes the significance of the rise of wholesale gas prices as a result of Russia's boundaries on the flow of gas to Europe and the possibility of additional limitations.

The cost of living in the UK rose significantly in 2021 and 2022, reaching a 41-year peak of 11.1% in October 2022. In February 2023, consumer prices were 10.4% higher than they were a year earlier. Food costs also rose rapidly, reaching a 45-year high in

February 2023. Energy prices, household energy tariffs, and road fuel costs are also increasing, with domestic gas prices increasing by 12.9% and domestic electricity prices by 67%. Gas and electricity prices reached record highs due to shortages of Russian supplies (Harari, Bolton, Francis- Devine& Keep, 2023).

The high inflation is affecting consumers and businesses. Real incomes for households are declining, while costs are growing for businesses. So, actual regular pay (excluding bonuses) fell by a record 3.9%, whereas businesses are facing higher energy prices and supply chain issues, which have slowed growth in some industries, such as manufacturing and construction (Chancellor of the Exchequer,2022).

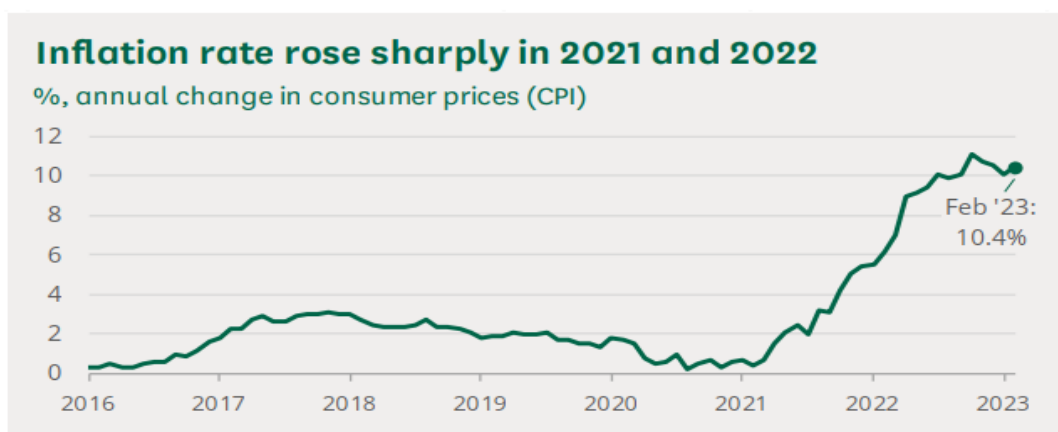


Figure2.1.

The inflation rate rose sharply in 2021 and 2022(Harari et al., 2023,p. 9).

2.3.2.2. Ukrainian War and Energy Prices

The international economy has been impacted by Russia's aggressive conquest of Ukraine. One of the main financial consequences for the UK is higher energy prices.

2.3.2.2.1. Ukrainian War

The Russian invasion of Ukraine has caused more financial spending in the UK economy.

Macaskill (2022) found that Britain has been one of Ukraine's major military equipment providers, supplying around 7,000 anti-tank guns, hundreds of missiles, and armored fighting vehicles. Additionally, it trains the Ukrainian military. According to Truss, the British military and economic assistance to Ukraine will continue. All citizens are invited to support the conflict in Ukraine. Even infants are surrounded by flags.

2.3.2.2.2. Energy Prices

During the Ukraine War, energy prices in the UK significantly increased as follows:

2.3.2.2.2.1. Oil prices

Even though it is not directly supplying the UK with gas, Russia is the top producers and exporters of gas and oil in the world. Oil prices rose above \$100 per barrel on February 24, 2022, during the full-scale invasion, reaching their highest level since 2014. They kept rising until they exceeded \$125. Prices progressively rose to about \$125 per barrel in the middle of June before declining over the next few months to below \$100 per barrel. Since December 2021, the most recent prices are about \$75 per barrel (Harari et al., 2023).

2.3.2.2.2.2. Gas prices

Harari et al. (2023) reported that on February 24, 2022, petrol prices in Europe rose by 50% to about 11 pence per kWh. Early in March, the daily price reached its peak of just over 17 p/kWh. It then began to decline again in April and May before rising again over

the summer, achieving numerous new records in late August. Since the spring of 2021, wholesale prices have been rising, which has resulted in significant rises in both family and commercial energy bills.



Figure 2.2.

Forward NBP Gas prices (Economic Report 2022, 2022, p.15).

2.3.2.2.2.3. Food and Metals

Harari et al. (2023) clarified that food costs have also increased because Russia and Ukraine are significant producers of variety of agricultural products, like wheat. They are also significant producers of a number of metals, and since the invasion began, these commodities' prices have risen as well on international markets. For instance, Russia is an important producer of palladium, which is used to create catalytic converters for car exhaust systems. In the months that followed the invasion, global agricultural and metals prices reached their highest level before falling back. In early February 2023 that industrial metal

prices had increased in late 2022 and early 2023, returning to an equivalent level to those before the invasion, while agricultural commodity prices had been mostly steady since the summer of 2022.

2.3.2.3. Brexit

According to Hayes (2021), Brexit, a combination of the terms British and exit, it refers to the decision made by the UK to quit the European Union after a vote on June 23, 2016. Brexit took place on January 31, 2020. The UK and EU agreed on a temporary free-trade deal on December 24, 2020, allowing for the unrestricted exchange of goods without taxes or quotas, but significant details continue to be unclear. This avoided a no-deal Brexit, which would have hurt the UK economy. Besides, the British pound dropped to its lowest level in 30 years as a result of the referendum vote, which disappointed expectations, and GDP growth slowed to 1.4% in 2018 due to a decline in business investments.

Following Brexit, the London stock market saw significant volatility. The Amsterdam and New York Stock Exchanges stole three-fourths of its derivative share trading. In addition, 440 banks and financial institutions departed the UK, and 10% of UK Bank assets were transferred to the EU. Furthermore, the service, transport, and hospitality sectors in the UK immediately experienced a lack of workers. Finally, with the signing of new trade deals with non-EU nations, the UK has strengthened its global connection and given UK consumers access to reduced costs (“Consequences of Brexit,” n.d.).

2.3.2.4. Growth Plan

As claimed by Nakisa (2022), the Sterling and the UK Government Bond Market had been in meltdown as a result of the government's announcing huge tax cuts in its mini-

budget. It's down by about 5 % to 7 % and is achieving \$1.04, which is the lowest level ever for the pound versus the dollar.

The government has chosen to fund an energy price guarantee and tax cuts to reduce inflation over the short term, but the way they have chosen to fund it is looking very risky. This puts a tremendous amount of pressure on the UK bond market and increases disparities in income. Additionally, the UK is running a double deficit, with a current account deficit representing 8.3% of the UK GDP and a fiscal deficit representing more than it earns in taxes. This plan has negative aspects for the UK economy, as it rattled markets when they worried about debt sustainability and the declining value of the pound sterling. Therefore, the Bank of England will need to put in a lot more effort to get inflation under control (Nakisa,2022).

In conclusion, the EU will have difficulties improving its supply security and addressing the energy-climate issue by transitioning to a low-carbon economy because this will be very expensive for the government and consumers. On the other hand, the UK economy is experiencing a downturn as a result of many factors, including the Ukrainian war, Brexit, the growth plan, etc., which lead to a spike in inflation, increasing the cost of living, lowering the real income of families, market turbulence, and a decline in the value of the pound sterling.

2.4. Devolved Nations' Specific Fuel Solutions

A variety of strategies are used in Wales, Scotland, and Northern Ireland for overcoming fuel poverty:

2.4.1. Wales

According to National Energy Action [NEA] and Energy Action Scotland [EAS] (n.d.), the Welsh government estimates, 98% of lower-income households may be in fuel poverty. So, on April 2022, The Welsh Government consequently launched a £38 million Winter Fuel Support Scheme to aid households receiving means-tested benefits in paying their winter fuel costs. Additionally, households receiving child tax credits, pension credits, disability benefits, carer's allowance, contributory benefits, and working-age means-tested benefits will be eligible for a second Welsh Fuel Support Scheme payment of £200. Besides that, The government has established a £4 million Fuel Voucher Programme and an additional £15 million to assist families who are struggling financially.

2.4.2. Scotland

NEA and EAS(n.d.) reported that higher energy costs have deepened fuel poverty in areas with high rates, such as the Western Isles and Highlands. Therefore, the government is taking steps to address rising energy costs and the cost-of-living crisis in Scotland. Firstly, the Low-Income Winter Heating Assistance benefit will provide £50 to all eligible households to support winter fuel costs. As well as, increasing Child Payment to £25 per week. Finally, Scottish households will receive support from a £20 million Fuel Insecurity Fund, which will also help fund crisis payments through local and national charities.

2.4.3. Northern Ireland

NEA and EAS(n.d.) suggested that consumers in Northern Ireland were subjected to increased energy rates due to a large number of PPM customers and the absence of a price cap. Consequently, the Minister for Communities introduces two programs to tackle growing energy prices. To start with, the Department for Communities, Bryson Charitable Group,

Consumer Council in Northern Ireland, and regional energy providers launched the £2 million Emergency Fuel Payments Scheme to provide 20,000 homes with £100 worth of energy. However, the scheme's demand was quickly exceeded and many households were unable to get support due to online applications. In addition, The £55m Energy Payment Support Scheme, is providing support to people who are having a hard time paying increasing energy costs. But, it was delayed due to the collapse of the Northern Ireland Assembly.

To review, devolved states offered a variety of support programs to assist families; the Welsh Government has introduced a Winter Fuel Support Scheme worth £38 million. The Scottish government provided households with the £50 Low-Income Winter Heating Assistance benefit, increased the Child Payment to £25 per week, and offered households £20 million from the Fuel Insecurity Fund, whereas Northern Ireland launched two schemes, including the £55 million Energy Payment Support Scheme and the Emergency Fuel Payments Scheme, which provided 20,000 homes with £100 worth of energy.

2.5. Long-Term UK Measures Against Energy Crisis

The government is adopting a set of actions to ensure the UK is more energy independent, safe ,and resilient, as follows:

2.5.1. Reducing Energy Consumption

As stated by HM Government(2023), the National Grid Energy System Operator (ESO) took extra steps to prepare for gas shortages and stopped imported electricity. The government was pleased with the ESO's efforts to maintain the remaining coal plants of Britain ready to supply additional energy production in the case that it is required. Besides that, it encouraged local gas production and worked with nations including the US, Qatar, the

European Union, and Norway to exchange knowledge concerning the supply and demand for energy.

According to the 2022 British Energy Security Strategy, the government will modify planning regulations to speed up the building of offshore wind farms in the hopes that they would be able to provide enough electricity by 2030 to power every house in the nation. In addition, the government plans to construct eight nuclear reactors to provide 25% of the UK's power by 2050. Simone Rossi claimed that more new nuclear will lessen Britain's reliance on foreign gas and maintain stable energy prices (Cooban, 2022).

2.5.2. Lowering Energy Dependency and Renewable Energy Transition

The greatest method to safeguard homes and businesses is to reduce the cost of the energy used and the amount utilized. This requires improving energy efficiency and developing a low-cost, low-carbon energy system to lessen dependency on fossil fuels (HM Government, 2023).

2.5.2.1. UK Energy Security Strategy

The British Energy Security Strategy was released by the UK government on April 7, 2022. The strategy prioritizes growing domestic energy production in the UK while simultaneously aiming at ending the import of Russian oil, coal, and gas as soon as possible. This plan suggests speeding the United Kingdom's shift to a low-carbon, energy-independent future (“British Energy Security Strategy,” 2022).

The Strategy considers natural gas as an important transition fuel and encourages an increase in local production. Some categories will be the main areas of focus:

- On-shore gas: the British Geological Society has requested a review of the information regarding seismic activity and shale gas geology (“The British Energy Security Strategy,” 2022).
- Offshore gas: the goal of the strategy is to produce up to 50GW of offshore wind power by 2030, with a tenth of that amount coming from turbines on floating platforms that can be placed in deeper waters further offshore (Thomson, Donoghue, & Hedges, 2022).
- Low carbon technologies: The term "carbon capture and usage" (CCU) refers to a collection of procedures for capturing waste CO₂ and using it in a way that is commercially beneficial, such as a feedstock in chemical operations (Mander& Miller, 2018).
- Carbon capture, storage, and utilization (CCUS) by 2030 is still a goal. The CCUS and hydrogen delivery strategies will be released soon to achieve this (“The British Energy Security Strategy,” 2022).
- Solar energy: The policy does not include a specific goal for solar energy, however, the government anticipates a five-fold growth to 70GW by 2035 (Thomson et al., 2022).

2.5.2.2. UK Hydrogen Strategy

As explained by Safdie (2022), U.K. Hydrogen Strategy is a plan established by the U.K. This strategy aimed at using low-carbon technology in factories and households to lower emissions and produce electricity. It consists of zero-carbon generation of electricity and green and blue hydrogen technologies. UK Hydrogen Strategy intends to cut emissions to zero by 2050.

Hydrogen is a dependable energy source that can be generated from renewable energy sources like wind, solar, nuclear, or biomass. By enabling new forms of transportation and lowering reliance on fossil fuels, it can help lower the emissions of compounds that harm the ozone layer. In addition, The U.K. Hydrogen Strategy will substitute a fifth of the gas consumed, enabling power plants to produce more clean energy. By doing so, the U.K. will be able to tackle climate change and accomplish its environmental and carbon reduction objectives. Hydrogen energy is hard to store because of high pressure and low temperatures. Even though a nation like the UK generates large quantities, the U.K. Hydrogen Strategy requires additional funding and careful planning to succeed (Safdie,2022).

In short, The UK government is taking measures to reduce energy consumption, encourage local energy production, and use sustainable energy. It launched two plans: the British Energy Security Strategy and the U.K. Hydrogen Strategy. The British Energy Security Strategy intends to improve domestic energy production and avoid importing Russian fossil fuels to produce more renewable energy, while the U.K. Hydrogen Strategy aims to use low-carbon technologies in factories and homes to cut emissions and generate electricity.

Conclusion

This chapter aims to demonstrate how the UK economy has been negatively affected by energy crisis. It also demonstrated the UK's reliance on a variety of energy sources, including imported energy, fossil fuels, renewable energy, etc. Besides, the EU faces serious obstacles in terms of enhancing supply security and tackling the energy-climate dilemma by shifting to a low-carbon economy, which will be very costly for both the government and consumers, as well as the UK economy, which is in a slump due to a variety

of causes, including the Ukrainian conflict, Brexit, the growth plan, etc., which have caused an increase in inflation, a rise in living costs, a decrease in real family income, and market volatility. The UK government has therefore implemented policies to decrease energy prices, for instance, the Winter Fuel Support Scheme, the Emergency Fuel Payments Scheme, and the Low-Income Winter Heating Assistance Scheme. Unfortunately, such policies did not lead to a satisfactory solution; instead, they exert pressure on the bond market and decreased the value of the pound sterling. Finally, the chapter covered the British Energy Security Strategy and U.K. Hydrogen Strategy, which were introduced by the government as the best ways to decrease energy usage, promote local production, discover alternative gas sources, and make investments in low-carbon energy in the next years to reduce greenhouse gas emissions.

General Conclusion

The present research investigates the European energy crisis and the impact of the crisis on the UK. In order to synthesize the major studies associated with the topic of the research, it has been examined in the relevant literature. The first chapter presented Europe's energy crisis during the Ukrainian War, while the second chapter covered the impact of the energy crisis on the UK.

To conduct this research, three questions are asked. The first question inquired about the impacts of the current energy crisis on Europe. The second question focused on the main obstacles that Europe and the UK faced during the energy crisis. The third question looked for the primary strategies and plans that Europe and the UK adopted to address this crisis both immediately and over the long term. Following the previous questions, three hypotheses are formulated. Hypothesis one links the conflict in Ukraine to the factors causing the energy crisis in Europe. Hypothesis two links Europe and the UK and their different challenges during the energy shock. Hypothesis three links Europe, the UK and their strategies to tackle the energy crisis and transit to renewable energy use. To get precise answers and test these hypotheses, various data were gathered from books and documents. In the analysis of the collected data, descriptive and historical methods are used. The findings of this research revealed that the energy crisis brought on by the invasion of Ukraine poses a serious risk to the European economy, particularly the UK, resulting in a spike in inflation, i.e., higher wholesale prices for electricity and gas, a drop in industrial production and real family incomes, a recession, and a delayed rate of economic recovery. The European Union has taken significant measures to address the energy problem, such as the REPowerEU

initiative, which intends to make Europe independent from the Russian energy supply by 2027 by switching to ship-imported LNG instead of Russian gas pipeline supplies. It has also adopted the EU Green Deal, which aims to reduce greenhouse gas emissions and make investments in renewable energy to ensure a sustainable energy future. The UK government has also revealed plans to deal with the crisis, such as the Winter Fuel Support Scheme, the Emergency Fuel Payments Scheme, and the Low-Income Winter Heating Assistance Scheme. These policies do not produce effective remedies; instead, they have pressured the bond market and lowered the value of the pound sterling. So, the UK government invested in low-carbon energy, discovered alternative gas sources, decreased energy usage, and encouraged local production for future generations.

To summarize, the energy crisis has harmed the economy of Europe. The study aimed to understand how the European energy crisis during the Ukrainian War would impact the UK. Thus, the hypotheses that were formulated regarding the relationship between the Ukrainian war and the effects of the energy crisis in Europe, Europe, UK and their various challenges, Europe UK, and their different policies, have been confirmed. After data analysis, it became apparent that the energy shock that followed the Ukraine war had a significant impact on both the UK and Europe as a whole. As a result, European countries have demonstrated a strong commitment to managing the energy crisis by adopting a multifaceted strategy. Through increasing energy efficiency, diversifying their energy sources, and integrating smart grids, they have made considerable progress in moving towards a sustainable energy future. However, challenges still exist, and continued efforts are required to further improve energy security, reduce carbon emissions, and guarantee a reliable and inexpensive energy supply for future generations. The European experience can serve as a useful example for other regions facing comparable energy challenges, emphasizing the

significance of a holistic and cooperative strategy to manage and mitigate the effects of an energy crisis.

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الملخص

يواجه الاقتصاد الأوروبي تدهورا كبيرا بسبب أزمة طاقة حادة وغير مسبقة. تهدف هذه الدراسة إلى الإجابة عن كيفية تأثير أزمة الطاقة في أوروبا أثناء الغزو الروسي لأوكرانيا على المملكة المتحدة في المدى القريب والبعيد. وتبحث هذه الأطروحة في الإستراتيجيات الضرورية التي لابد لأوروبا من اتخاذها للخروج من هذه الأزمة وكذلك البحث في مستقبل المملكة المتحدة. لقد تم استخدام منهجية وصفية وتاريخية لإنجاز هذه الأطروحة. توصلت هذه الدراسة إلى عدة نتائج أهمها التأثير الكبير لأزمة الطاقة على أوروبا والمملكة المتحدة على وجه الخصوص والذي تمثل فيما يلي: الضغط على سوق الجنيه الأوروبي وارتفاع أسعار الطاقة والفواتير والغذاء وانخفاض الدخل للأسر. في حين تم اتخاذ عدة تدابير من طرف أوروبا و المملكة المتحدة على وجه الخصوص لمعالجة هذه الأزمة على سبيل المثال تقليل استهلاك الطاقة ، قطع أو تقليل الاعتماد على النفط والغاز الروسي ، وتسريع التحول إلى الطاقة المتجددة و النظيفة.

الكلمات المفتاحية: أزمة الطاقة ، أوروبا ، المملكة المتحدة ، الغزو الروسي لأوكرانيا.