Global Changes and Shifts in Energy Demand from 1965 to 2021

BAHRI Halima [1], BENBOUZIANE Mohamed [2]

[1] Oran Graduate School of Economics, Lab LAREEM, (Algeria), halima.bahri87@gmail.com

[2] Abou Bekr Belkaid Tlemcen University (Algeria), mbenbouziane@yahoo.fr

Received: 24/09/2023 *Accepted: 10/12/2023* *Published: 30/12/2023*

Abstract:

In a rapidly changing world marked by population growth, urbanization, economic shifts, and dynamic political landscapes, global energy demand has soared to unparalleled levels. This presents a complex challenge that transcends borders. . Economic, political, and health events significantly shape energy demand patterns. This study investigates the impact of these factors on energy use across seven regions, providing insights into the global energy puzzle. It reveals disparities in consumption growth rates and the shifting epicenter of energy demand towards developing countries. While offering opportunities, the global demand surge necessitates a move towards sustainable energy practices. The research spans from 1965 to 2021, analyzing data from the BP Statistical Review of World Energy 2022. By unravelling these complexities, the study aims to guide the path towards 0sustainable energy solutions.

Keywords: energy demand; energy consumption; renewable energy; fossil fuel.

Jel Classification Codes: P18, Q20, Q40

Corresponding author: *BAHRI Halima*, Oran Graduate School of Economics (Algeria) , ***e-mail:*** *halima.bahri87@gmail.com*

1. INTRODUCTION

In an era characterized by a whirlwind of change, including rapid population expansion, sprawling urbanization, economic growth, technological leaps, and ever-shifting economic and political landscapes, the world's appetite for energy has reached unprecedented heights. The surge in global energy demand presents a multi-faceted challenge that transcends geographical boundaries. As population burgeons, cities sprawl, energy needs soar. Simultaneously, economic and political events, as well as health crises, wield significant influence over the ebb and flow of energy demand patterns. Developing nations grapple with electricity shortages and heavy reliance on imported oil, while advanced economies confront the pressing imperative to curtail fossil fuel dependency and combat climate change through the adoption of renewable energy sources. Deciphering the intricacies of energy consumption across diverse regions is pivotal for crafting effective policies and strategies that foster sustainable energy use. This study embarks on a journey to investigate the reverberations of economic and political factors on energy demand in seven distinct regions, offering insights into the global energy puzzle.

The pace of energy consumption growth is far from uniform across nations. In developed countries, energy consumption grows at a modest 1%, while in developing countries, this rate surges fourfold (Arbex & Perobelli, 2010). This disparity underscores the complexity of global energy challenges and necessitates tailored approaches for different regions.

As underscored by (United Nations, 2020), the epicenter of burgeoning globe energy demand is shifting toward developing countries. This shift is attributed to their robust economic growth, a convergence of living standards with developed economies, increased accessibility to marketed energy, and rapid population growth and urbanization in specific regions.

This escalating global demand for energy presents both challenges and opportunities for the sustainable energy sector. This trend, evident across high- and low-income nations alike, is heavily reliant on fossil fuels. Such dependence contributes significantly to climate change, with far-reaching consequences affecting the entire planet. To mitigate these challenges, it is imperative to explore sustainable energy alternatives that align with environmental objectives (Hite & Seitz, 2021).

This study delves deep into the intricate tapestry of factors shaping global energy demand patterns. From the forces of economic growth, population growth and urbanization to the catalysts of technological

innovation and economic dynamics, our research strives to illuminate the complex interplay that moulds energy usage worldwide. In this endeavour, we scrutinize energy consumption curves spanning seven diverse regions: North America, Central and South America, Europe, the Commonwealth of Independent States, Africa, the Middle East, and the Asia-Pacific. Our aim is to untangle the profound influence of economic, political and social dynamics on the world's energy demand. In doing so, we aspire to decode the enigma of global energy demand and chart a course toward sustainable energy practices.

The following problem arises: **How can the global community effectively address the challenges posed by the unprecedented surge in energy demand, influenced by economic, political, and health factors, while transitioning towards sustainable energy practices and ensuring equitable access to energy resources among developing countries?**

Hypothesis:

"The study hypothesizes that the dynamics of economic, political, and social factors significantly shape energy demand patterns in distinct regions across the globe. Disparities in the growth rates of the energy consumption between developed and developing nations underscore the need for tailored strategies to address the challenges and opportunities presented by the surge in global energy demand .

This investigation encompasses a temporal span starting from the year 1965 and extending to the present day. However, the specific time frame for the analyzed energy consumption curves is based on extracted data from bp Statistical Review of World Energy 2022 (BP, 2022), spanning from 1965 to 2021. These data represent the consumption quantities of various energy types, measured in Exa-joules, and were meticulously compiled using the Eviews programm, seeking to unravel the complex interplay of influences that have steered the utilization of fossil, renewable, and nuclear energy sources within these regions.

The research paper is organized as follows. The second section gives a comprehensive overview of the theoretical framework kicking off by delving deep into the theoretical foundations that underpin our study. Five primary facets take center stage: economic growth, population growth, urbanization, the impact of the Covid-19 pandemic on global energy demand, and the impact of Political events and global crises on global energy demand. The context of the study and the analysis of consumption curves are presented

and discussed in the third section. Finally, in the fourth section, we present the results obtained and the conclusion

2. Literature Review

Energy consumption as a whole is affected by many economic, social, political factors that change over the years, such as population growth, economic expansion, and urban resident flows (Rehman & Deyuan, 2018). Understanding the linkage between economic growth, electricity access, energy use, and population growth is crucial in analyzing energy demand patterns (Rehman & Deyuan, 2018), including energy and economic crises and pandemics. These changes show how these factors interact to determine energy consumption levels worldwide over the decades.

2.1 Economic Changes

2.1.1 Economic Growth

Economic growth plays a crucial role in shaping energy demand patterns both within a country and globally. As a nation experiences economic expansion, its energy demands tend to rise in tandem, driven by increased production activities, industrialization, and rising living standards(Arbex & Perobelli, 2010). This surge in energy requirements has implications beyond national boundaries due to the interconnectedness of economies in a globalized world. The interconnectedness of economies means that changes in energy consumption in one country can have reverberating effects on others. Increased imports of goods from economically booming nations lead to energy-intensive manufacturing processes in exporting countries, affecting their energy consumption levels and associated environmental considerations. Furthermore, economic growth in one country can stimulate demand for energy resources on an international scale, as emerging economies rely on energy imports to meet the needs of their expanding populations and industries. This affects global energy markets and can result in price fluctuations(Arbex & Perobelli, 2010). There is a causal relationship between GDP and energy consumption in Taiwan and the Philippines, indicating that economic growth drives increased energy consumption(Chiou-Wei, Chen, & Zhu, 2008). This supports the notion that energy is an essential factor in a country's economic development, and as economies advance, there is a corresponding growth in their energy needs. Energy consumption is often used as a proxy for economic growth, as higher levels of economic development tend to induce more energy consumption (Arbex & Perobelli, 2010; Zaheer Khan Kakar, 2011). However, the relationship between economic growth and energy consumption is complex,

as efficient energy consumption also requires a higher level of economic growth (Anis Omri & Kahouli, 2014).

Conceptually, energy consumption in an economy is directly influenced by economic growth, energy price, and urbanization (Komal & Abbas, 2015). Understanding the interdependence of economic growth and energy consumption is of utmost importance, as their correlation has significant policy implications (Wang & Zhang, 2021).

2.1.2 Population Growth

The population plays a significant role in energy demand in worldwide. Several studies conducted by energy demand researchers have explored the connection between the growth in energy demand and population growth. Through empirical research, these studies have confirmed the correlation between energy demand and population levels in countries such as Germany, China, and the United States. The prevailing perspective on the energy-population relationship suggests that the energy demand is influenced by population size. In other words, as the population increases, the overall energy requirement also rises, and the specific amount of energy needed depends on the per capita energy consumption (Batliwala & Reddy, 1994).

With the global population expanding and undergoing urbanization and economic advancement, the associated energy demand is projected to rise accordingly and potentially double by 2050 (Khan, Hou, Irfan, Zakari, & Le, 2021).Therefore, the population is a crucial factor to consider in analyzing energy demand.

Today, economists are discussing the relationship between global changes in energy demand and population growth. They analyze energy trends worldwide and the driving factors, including population growth. They also emphasize the need to explore the optimal use of energy resources to meet the growing energy demand resulting from population growth. This is one of the contributing factors to the increase in global energy demand. It is estimated that global energy demand will double during the first half of the twenty-first century and triple by the end of the century due to the increasing world population. This will be further amplified by the rising per capita energy consumption (Foster, Ghassemi, & Cota, 2009).

In addition, this growth in demand will primarily occur in developing countries, where more than 80% of future global energy demand growth is expected to take place. (Harris & Roach, 2018). With rapid population growth and increasing demand for fuel, and energy simultaneously, it is

imperative for policymakers to take steps to mitigate the impact of these trends (Kurtzman, Fell, & Boekhout, 2010).

2.1.3 Urbanization

According to (Amin & Rahman, 2019), urbanization, characterized by the migration of the rural workforce to urban regions focused on industrial activities and social networks, has a significant impact on energy demand. With urbanization, in particular, amplifying the demand for both energy in general and electricity in particular. It's worth highlighting that urbanization has gained prominence as a pivotal variable in recent models, like the Environmental Kuznets Curve (EKC), elucidating the nexus between energy, economy, and the environment, as emphasized by (Özcan & Ozturk, 2019).Similarly, (Salman Haider, 2019) highlights the role of urbanization and industrialization as key drivers of increasing energy demand. However, predicting the precise effect of urbanization on energy consumption remains challenging(Salman Haider, 2019). Transportation and population density are among the various factors influencing this relationship(jones, 1991; Madlener & Sunak, 2011).

Recent studies, including those by (Islam, Shahbaz, Ahmed, & Alam, 2013), (Menegaki & Ozturk, 2013), and (Shahbaz & Lean, 2012), have expanded our understanding of this relationship by considering financial development and urbanization. (parikh & shukla, 1995) found a positive impact of urbanization on energy consumption using data from developed and developing countries between 1965 and 1987. They revealed that residential energy consumption is indirectly linked to urbanization through its connection to labor productivity (Krey et al., 2012).

Urbanization affects energy use through various channels, such as production, mobility, transportation, and infrastructure (Sadorsky, 2013). Concentration of production in urban areas fosters economic activities, while improved mobility and transportation facilitate efficient transportation facilities. Additionally, enhanced urban infrastructure reinforces efficient energy utilization (Salman Haider, 2019). It is important to note that the increased energy demand associated with urbanization may be attributed to inefficiencies in energy use (Salman Haider, 2019). During the initial phases of urbanization, as urbanization rates and per capita income increase at similar rates, productivity rises due to the shift of resources from lower-productivity rural activities to higher-productivity urban activities. This shift results in overall productivity gains as more efficient and productive activities are pursued in urban areas. Furthermore, (Dramani & Tewari, 2014)

argue that improved electricity markets and distribution systems can contribute to the positive impact of increased urban population on electricity consumption, as better access to electricity and appliance utilization become possible.

2.2 Changes In Political Events And Global Crises

2.2.1 The Impact of COVID-19 on Global Energy Demand :

After the declaration of the COVID-19 outbreak in January 2020 and later as a pandemic in March 2020 by the World Health Organization (WHO, 2020) governments implemented measures such as lockdowns, travel restrictions, and quarantine protocols to curb the virus spread. These actions had a significant impact on global economic growth and energy demand. The Organization for Economic Co-operation and Development (OECD, 2020) reported a sharp decline in the real gross domestic product (GDP) of all countries except China in 2020.

The COVID-19 pandemic had a multifaceted impact on global energy dynamics. it resulted in reduced energy demand due to the widespread restrictions and lockdowns that were implemented to curb the virus's spread. These measures led to diminished economic activity, with industries such as manufacturing, aviation, and tourism experiencing scaled-down operations or temporary closures. Consequently, energy consumption in these sectors decreased significantly. Additionally, the pandemic altered transportation patterns, with remote work arrangements and travel restrictions causing a notable reduction in transportation-related energy demand, affecting areas such as aviation, automotive, and public transit. Furthermore, the pandemic induced changes in energy demand patterns within commercial and office spaces. The closure of offices and commercial establishments translated to decreased energy use, as lighting, heating, cooling, and electronic equipment in these spaces were utilized less frequently. On the global stage, the pandemic triggered a significant impact on oil prices. The plummeting demand for oil, coupled with a price war between major oil-producing nations, led to a sharp decline in oil prices, with far-reaching economic consequences for both oil-exporting countries and the broader energy industry.

According to the International Monetary Fund (IMF, 2020), the COVID-19 pandemic had a severe impact on economies worldwide, especially in developed countries such as France, Italy, and Spain. The energy sector also experienced significant effects, with countries under complete lockdown witnessing a 25% average decrease in weekly energy

demand, while countries under partial lockdown experienced an 18% decrease. However, China stood out amidst the COVID-19 crisis, as it not only achieved economic growth in 2020 despite the global downturn but also demonstrated a rapid recovery. The IMF (2020) predicted that China's growth rate in 2021 will reach 8.2%, surpassing that of other countries. Based on real Smart Meter infrastructure data from Manzanilla, Spain, reveals that residential customers increased their consumption by around 15% during full lockdown and 7.5% during the reopening period. Non-residential customers, on the other hand, decreased their consumption by 38% during full lockdown and 14.5% during the reopening period. The analysis also identified different consumption profiles among non-residential customers, indicating varying behaviours during the COVID-19 crisis. These behaviors were correlated with the restrictions imposed to control the virus spread (Garcia et al., 2021).The behaviour of the residential consumption was characterized by a remarkable increase during the quarantine.

Numerous governmental organizations, including the World Energy Council (WEC), International Energy Agency (IEA) and major international oil organizations, have conducted extensive research on future global energy forecasts. In the realm of renewable energy, the pandemic presented its own set of challenges. While sources like wind and solar continued to generate electricity, the overall drop in electricity demand strained the economics of certain renewable energy projects. During lockdowns and periods of reduced demand, some solar and wind installations had to curtail their electricity generation, affecting their efficiency and economic viability. Moreover, the pandemic wreaked havoc on global supply chains, affecting the procurement of energy equipment and materials. These disruptions had tangible repercussions on the construction and maintenance of energy infrastructure, including renewable energy projects. Additionally, uncertainty stemming from the pandemic led to delays in investment decisions for energy initiatives, affecting the growth and development of renewable energy infrastructure and other energy-related projects.

2.2.2. The Impact of Political Events and Price Volatility on Global Energy Demand:

In the realm of geopolitics, certain events can send shockwaves through the global energy landscape, reshaping supply and demand dynamics while causing price volatility. A notable example of this phenomenon is Russia's war on Ukraine, which has had a significant impact on the global energy market causing fluctuations in supply and demand as highlighted by multiple

authors (Susanne.A & Wengle, 2022). As it is a major part of the global energy system thanks to its huge fossil fuel resources. and it is the world's third largest oil producer after the US and Saudi Arabia, accounting for 12% of global output, and the second largest gas producer after the US, responsible for 17% of the global output (CarbonBrief, 2022). Europe also relies heavily on Russian energy supplies, receiving approximately 70% of the country's gas exports and half of its oil exports, according to official statistics from the United States. It should be noted that the conflict has led to a surge in energy prices globally while also causing multinational companies such as BP, Shell, and ExxonMobil to withdraw from extractive projects in Russia due to sanctions(Susanne.A & Wengle, 2022).

Furthermore; the war will reduce Russia's strategic exposure to the West by reducing the level of energy interdependence between Russia and the EU(Buchanan, 2021). And this has significant implications for the EU, in addition to the fact that the EU is heavily dependent on Russia for deliveries of both oil and gas(Mankoff, 2011). The war has also caused tensions in the supply and demand of crude oil, natural gas, and other energy sources, leading to an increase in the price of energy(Jiang, Shvets, & Mallick, 2023).Unfortunately, this has led to a shift in demand towards carbon-intensive coal(Roach, 2022). Moreover, Russia has been gradually reducing the gap between its energy prices and international energy prices since 2005, reflecting its growing desire to control energy prices (Balli, Nee, & Qalati, 2022).

Russia has been diversifying its energy and economic partnerships, with China emerging as an important player. While Europe remains the primary destination for Russian energy exports, there has been a growing focus on cooperation with China, where it seems that China could provide crucial economic support to Russia, helping it navigate the challenges posed by sanctions stemming from its invasion of Ukraine. One potential avenue for this support is an increased purchase of energy resources from Russia. Therefore, the conflict has highlighted the significant impact that political factors can have on the energy market and the need for diversification to mitigate the impact of such conflicts. Importantly, these alternative options differ in terms of the timeframe within which they could significantly reduce European demand for coal, oil, and gas imported from Russia. Furthermore, one of the effects of the Russian invasion of Ukraine on the dynamics of the global energy market, including the European natural gas market, is the increased demand for alternative sources of natural gas, as well as an increase

in demand for natural gas from other sources, including Algeria. Algeria is the second largest exporter of natural gas to Europe after Russia. Algeria strategy is currently concerned with making the most of the stakes of the global crisis, by increasing natural gas production and liquefied gas production to compensate for Europe's gas needs, in addition to its interest in reaching a sustainable energy mix to meet local demand and directing the rest to export (Belmahi & Gueddal, 2023) . The recent upgrades to Algeria's export infrastructure have played a crucial role in enabling the country to export more natural gas. These infrastructure improvements enhanced Algeria's export capabilities, allowing them to respond to the changing demands and market conditions caused by the geopolitical events. Algeria's natural gas exports to Europe increased by 43% in 2021, according to BP's 2022 SRWE, Turkey was the primary destination for Algeria's liquefied natural gas (LNG), accounting for over 38% of Algeria's total exports. Additionally, European Union (EU) countries collectively received over 50% of Algeria's LNG exports.

In the United States, precisely In January 2023, natural gas consumption in the residential and commercial sectors reached its lowest level since 2017, averaging 106.8 Bcf/d, while February consumption averaged 104.5 Bcf/d, the lowest since 2018. Consumption in these sectors was down 16% in January and 12% in February compared to the same period in 2022, primarily due to the geopolitical tensions and instability resulting from the invasion had significant implications for the energy sector, including natural gas consumption in the United States.

One of the main reasons for the decrease in natural gas consumption in the residential and commercial sectors can be attributed to the rising prices and supply disruptions in the global natural gas market caused by the Ukraine conflict where the invasion led to heightened concerns about the stability of natural gas supply from Russia. In response to the escalating tensions and uncertainties, natural gas prices soared, making it less economically viable in the United States to consume natural gas at previous levels. This prompted many consumers to adopt energy-saving measures, switch to alternative energy sources, or reduce their overall energy consumption.

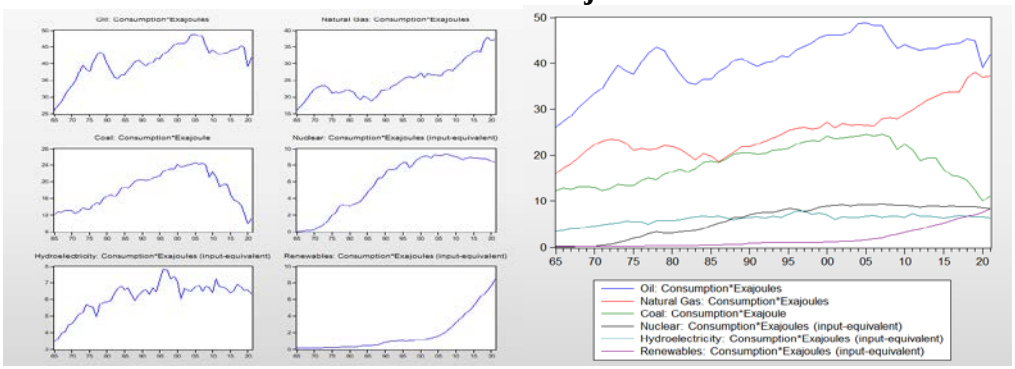
Furthermore, the volatility in the natural gas market resulted in supply chain disruptions, affecting the availability of natural gas in some regions. These supply constraints further contributed to the decrease in consumption as consumers faced challenges in accessing an adequate and affordable supply of natural gas.

3. Analyzing Global Energy Demand Shifts: A Comprehensive Framework for Understanding Trends and Curves

At the heart of this study lies a comprehensive and multidimensional framework. This framework constitutes a fusion of economic, sociopolitical, and technological perspectives. Aiming to provide a holistic understanding of the forces shaping energy usage worldwide, the study employs an analytical lens that spans seven distinct regions, allowing us to discern the diverse influences that steer energy practices across North America, Central and South America, Europe, the Commonwealth of Independent States, Africa, the Middle East, and the Asia-Pacific. To achieve this, we draw on meticulously curated data from the BP Statistical Review of World Energy 2022, spanning nearly six decades from 1965 to 2021.

3.1 Total North America :

Fig1: "Trends in Energy Consumption in North America from 1965 to 2021 in Exajoules "



Source: "The plotted data was created by the authors via Eviews program."

The data in previous years reveals the relative stability of coal consumption by North America. However, since the mid-1970s until the beginning of the 21st century, a clear upward trend became evident. This can be attributed to the oil crisis experienced by the United States and many other countries, which resulted in increased oil prices and limited availability. The rise in coal consumption was a strategic response to mitigate reliance on oil and meet energy demands. Additionally, North America relies on coal in certain sectors due to its availability, cost-effectiveness, and relatively sustainable coal reserves in the region. From 2000, coal consumption exhibited gradual fluctuations until 2008, reaching relatively higher levels than at the beginning of the 21st century, followed by a noticeable decline from 2008 to 2020. The decrease in coal consumption can be attributed to several factors, including increasing environmental concerns, regulatory

efforts to curb greenhouse gas emissions, and a shift towards cleaner and more sustainable energy sources.

Additionally, the data indicate that natural gas has a slight growth since 1965 until the early 1970s, followed by a downward trend until the mid-1980s due to higher gas prices resulting from the global energy crisis. Subsequently, there was a resurgence in natural gas consumption until 2021 with minor fluctuations. The overall upward trend is indicative of a growing reliance on natural gas for residential energy needs, driven by factors like population growth, urbanization. The data also shows that the natural gas consumption curve is noticeably increasing, whereas the coal consumption curve has been steadily declining since 2008. This trend can be attributed to the global financial crisis, which led to policy shifts by governments due to environmental concerns. The consumption trends for oil and natural gas follow a similar upward trajectory with some slight variations. It is notable that at the beginning of the new millennium, oil prices increased after a period of stability due to the Western energy crisis. This led to a relatively stable oil consumption and a decline in investments in energy production. It was followed directly by a significant decrease due to the global financial crisis in 2008, where oil prices reached their all-time high of $147 per barrel in July 2008. This decline persisted until 2012, after which oil consumption resumed its growth trajectory but experienced a significant downturn due to the negative impacts of the COVID-19 pandemic on the energy sector.

Regarding hydroelectricity and nuclear energy, both sources have been experiencing continuous growth, albeit in smaller quantities compared to fossil fuels. The data indicates roughly equal levels of consumption for hydroelectric and nuclear energy around 5.5 Exa-joules between 1987 and 1988. By 1997, both forms of consumption had increased to 7.7 Exa-joules each, but there was a shift in consumption patterns. North America started consuming larger quantities of nuclear energy instead of hydroelectricity. This can be attributed to the effectiveness of nuclear reactors in meeting energy needs, particularly in densely populated areas.

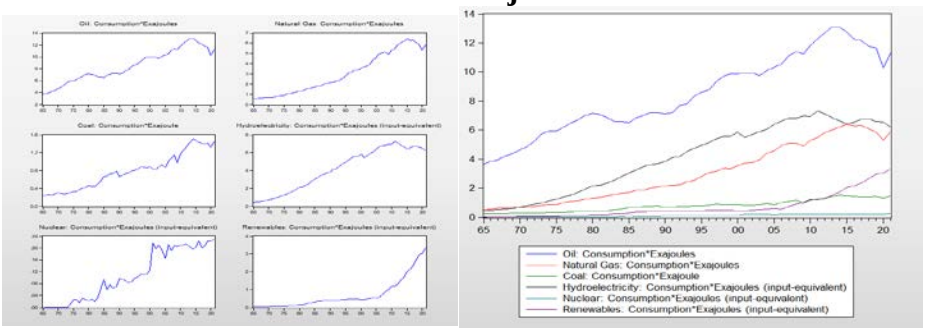
The data demonstrates a significant increase in renewable energy consumption by North American residents from 1965 to 2021. The values start at relatively low levels but exhibit a sharp upward trend over the years, where the year 1965 recorded a value of 0.15 Exa-joules, and since 1993 it began to increase to reach 1 Exa-joules, reaching the highest value in 2021 at 8.44 Exa-joules. This can be attributed to the growing awareness and

increasing concern about environmental issues, particularly climate change, leading to a greater emphasis on sustainable and clean energy sources.

3.2 Total S. & Cent. America:

In the Central and South America region, we observe that energy consumption follows an upward trend with slight fluctuations over different times. It is evident that both oil and natural gas follow a similar trajectory, but with varying quantities consumed based on the region's local importance as an oil-producing area.

Fig2: "Trends in Energy Consumption Total S. & Cent. America From 1965 to 2021 in Exajoules "



Source: "The plotted data was created by the authors via Eviews program."

Regarding oil, Central and South America being a significant oil-producing region relies more on this natural resource for local consumption. Global energy crises, such as the 1973-oil crisis, influence consumption trends, leading some countries to increase their usage of locally produced oil to enhance self-sufficiency and reduce dependence on oil imports.

As for hydroelectricity, we noticed an increasing reliance on it compared to natural gas, which was consumed more heavily in earlier years (until 1970). This shift is attributed to technological advancements and a growing interest in renewable energy, as countries recognize the importance of sustainable energy sources and reducing harmful environmental emissions.

For coal consumption, there was an increase in earlier periods followed by a decline in later years. The early increase in coal usage is associated with the availability of local resources and their relatively low cost. However, later on, global energy crises impacted consumption patterns, prompting countries to transition to alternative energy sources to mitigate the environmental impact of coal consumption.

Nuclear energy, characterized by fluctuations and low consumption rates, may be due to technical and environmental challenges associated with

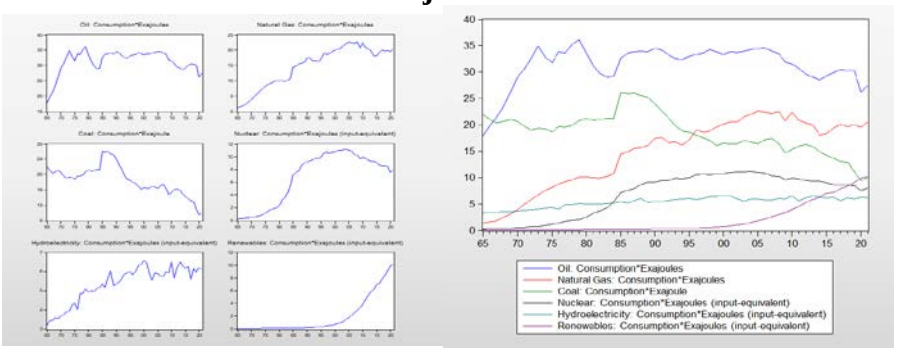
nuclear power usage, coupled with increasing concerns about nuclear safety and waste management.

During the COVID-19 pandemic and its global economic repercussions, we observed a decrease in consumption of all fossil fuels in 2020. This decline is likely a result of the pandemic's impact on the global economy, with precautionary measures and lockdowns leading to reduced economic activity, mobility, and transportation, subsequently lowering energy demand.

Conversely, consumption of renewable energies and hydroelectricity continued to rise and expand even in 2020. This trend can be attributed to a global shift towards more sustainable and environmentally friendly energy sources.

3.3 Total Europe:

Fig3:"Trends in Energy Consumption Total Europe from 1965 to 2021 in Exajoules "



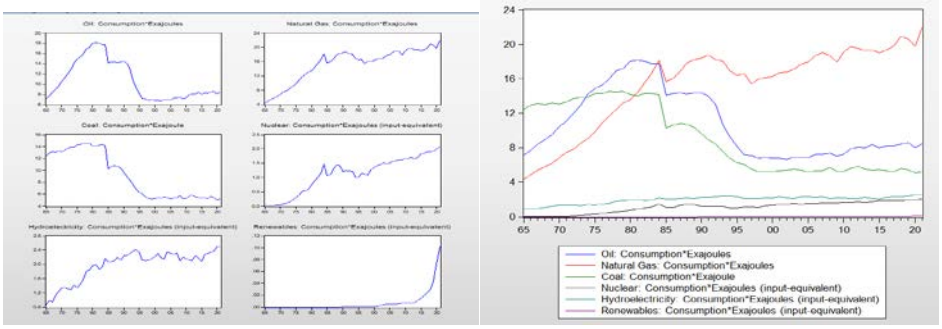
Source: "The plotted data was created by the authors via Eviews program."

Unlike the Americas, the energy consumption trend in Europe shows significant differences. We observe a steep rise in consumption since the beginning of the study period until the first oil crisis in 1973. Following that, there were two years of decline, followed by another increase. However, the second oil crisis in 1979 led to a stabilizing of consumption until the mid-1980s, after which the consumption started rising again Followed by partial stabilization in consumption and steadiness. The global financial crisis of 2009 had a clear impact on the consumption trend, showing a noticeable decline until 2015, followed by a gradual recovery. Regarding coal consumption, there was a continuous decline throughout the study period, except for the period between 1975 and 1985 when Europe had to rely on coal due to the energy crisis at that time. Generally, 1985 saw an increase in consumption for all types of energy. As for nuclear energy, it experienced continuous growth from 1965 until 1993, after which it stabilized until 2006.

Subsequently, it began to decline due to government agreements and legislation aimed at reducing nuclear energy production for environmental safety concerns. Hydropower consumption showed a steady, slight increase, while renewable energy sources exhibited a steep, exponential rise since the early 20th century due to technological advancements. Notably, in 1966, Europe experienced a significant shift, with oil surpassing coal as the primary energy source, which was previously dominant in consumption. In 1995, natural gas surpassed coal, which continued its decline. In 1984, nuclear energy overtook coal in consumption, and in 2019, renewable energy sources surpassed both nuclear and coal consumption.

3.4 Total CIS:

Fig 4: "Trends in Energy Consumption Total CIS from 1965 to 2021 in Exajoules "



Source: "The plotted data was created by the authors via Eviews program."

Commonwealth of Independent States (CIS) was founded in 1991, previously consisting of republics within the Soviet Union. However, with the establishment of the CIS, three countries, Latvia, Estonia, and Lithuania, withdrew. From the data, we notice that between 1965 and 1973, coal was the primary energy source for CIS countries, with coal consumption surpassing that of oil, natural gas, and other energy sources, including nuclear and hydro energy. By 1974, the consumption of oil exceeded the consumption of other energy sources that had been increasing steadily since 1965 until 1981. The global oil crises in 1973 and 1979 had a positive impact due to the rise in oil prices, as the Soviet Union was a major oil exporter, resulting in increased revenues and higher consumption. However, in the early 1980s, with the deterioration of global oil prices, the consumption levels stabilized, unlike natural gas, which continued to increase due to its different pricing mechanism, with the impact being less immediate.

By 1980, natural gas consumption exceeded that of coal, followed by oil consumption in 1984. The consumption of all fossil fuels, including oil, gas, and coal, decreased in the following years due to the 1986 global oil

crisis and the significant price drop. Partial stability followed price improvements between 1987 and 1990. In 1991, the Soviet Union disintegrated, and the CIS was established, leading to the independence of these countries. Consequently, the consumption trajectory for all fossil fuels was affected, compounded by the aftermath of the Iraqi invasion of Kuwait, which caused a collapse in the global oil market. Prices skyrocketed, and demand increased, leading to a massive surplus from OPEC member states and the implementation of the International Energy Agency's agreement to draw on company reserves, resulting in a drastic decline in oil prices and, consequently, the financial revenues of oil-exporting countries within the CIS. This led to reduced consumption.

The situation continued until the late 1990s, with the decline persisting until 2008, albeit not as severe. This was followed by a fluctuating minor increase. The COVID-19 pandemic in 2020 resulted in a decrease in consumption due to the global lockdown policies, and afterward, consumption started to rise gradually.

In the early period (up to the mid-1990s), nuclear energy consumption was steadily increasing, thanks to technological advancements and reliance on nuclear energy for electricity generation in the member states. From the mid-1990s to 2000, nuclear energy consumption experienced a slight decline, possibly due to the repercussions of nuclear accidents, such as the Chernobyl disaster in Ukraine in 1986. 2000 to 2021, nuclear energy consumption witnessed a gradual increase once again, driven by the growing demand for electricity and the need for clean and sustainable energy sources.

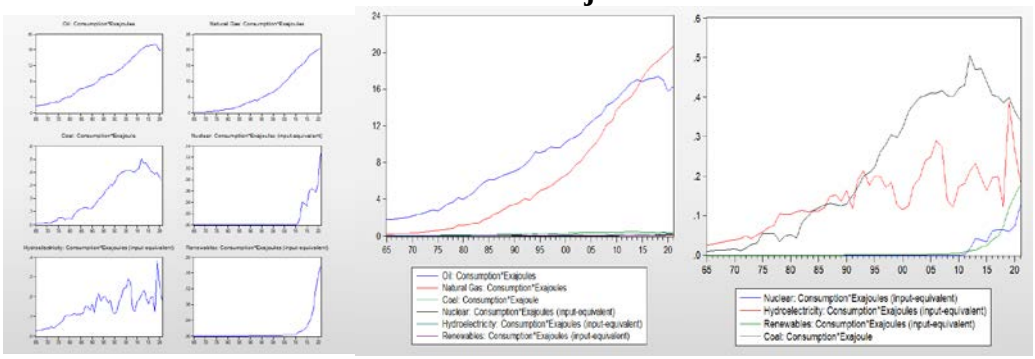
As for hydroelectricity consumption, it showed a slight and fluctuating increase from 1965 until the mid-1990s. This can be attributed to some countries' adoption of hydropower as a source of electricity and their efforts to reduce reliance on traditional sources like coal and oil. After the mid-1990s (until 2021), hydropower consumption experienced a gradual decline, which might be a result of some countries shifting to a more diversified energy mix and the impacts of climate change on water resources availability. Since 2006, there has been a noticeable increase in the consumption of renewable energy in the Commonwealth of Independent States. This reflects the global trend towards using more sustainable and clean energy sources instead of traditional fuels.

Moreover, this rise in renewable energy consumption is a result of the development of renewable energy technologies such as solar, wind, biofuels, and others. It is also driven by government’s efforts to encourage the use of

renewable energy through the development of policies and economic programs. Overall, the trend indicates a shift towards more sustainable and diverse energy sources in the region, which aligns with global efforts to mitigate climate change and ensure energy security.

3.5 Total Middle East:

Fig 5: "Trends in Energy Consumption Total Middle East from 1965 to 2021 in Exajoules "



Source: "The plotted data was created by the authors via Eviews program."

During the period from 1965 to 1979, the Middle East region experienced a significant and continuous increase in oil consumption. This surge in demand was primarily driven by rapid economic growth and the development of the transportation and industrial sectors. During this period, oil consumption escalated from approximately 1.77 exa-joules in 1965 to nearly 4.15 exa-joules in 1979.In the same year, the world faced a new oil crisis due to the Iranian Revolution and the Iran-Iraq War. These events led to a decline in oil supplies and a surge in oil prices, which subsequently affected oil consumption in the region. Oil consumption decreased to approximately 3.67 exa-joules in 1980.Following the second oil crisis, the region witnessed relative stability in oil consumption. Some countries began diversifying their economies and embracing alternative energy sources. Oil consumption stabilized at around 4 exa-joules .During the period from 1990 to 2000, Middle Eastern countries experienced rapid economic growth, primarily attributable to rising oil prices and increased government spending. Oil consumption increased from about 4 exa-joules in the late 1980s to approximately 6.63 exa-joules in 2000.Economic growth continued, and oil prices reached record levels between 2000 and 2008, driven by advancements in modern technology. Oil consumption rapidly rose to its peak, reaching approximately 9.72 exa-joules in 2008. However, between 2008 and 2020, oil consumption in the Middle East began to decline following the global

economic recession in 2008. This decline was particularly pronounced in 2014 and 2015 when oil prices experienced a sharp drop. This had a significant impact on oil revenues in Middle Eastern countries, prompting them to reduce consumption and seek alternative energy sources.

In 2020, the decline in oil consumption was further exacerbated by the COVID-19 pandemic, when oil consumption dropped to around 6.08 exa-joules. With ongoing efforts to combat the COVID-19 pandemic, oil consumption began a gradual recovery in 2021, reaching approximately 7.27 exa-joules

Overall, the Middle East's approach to natural gas has been characterized by a more stable and upward trajectory compared to the volatility often associated with oil. The region has leveraged its abundant gas reserves to meet growing energy demands both domestically and internationally. Except for approximately 1993, when it recorded a slight decline. This was due to the Iraqi war on Kuwait, where the oil and gas infrastructure in Kuwait and Iraq was severely damaged. Oil fields, production and export facilities were destroyed, leading to a significant decline in production and exports after the war.

The consumption of nuclear energy in the Middle East saw a significant shift between 2011 and 2021, going from almost non-existent to substantial. This shift can be attributed to technological advancements in the field of nuclear energy, with safer and more economically viable techniques for electricity generation. This made nuclear energy more attractive as a clean alternative to oil and gas.

Some countries in the region also entered into agreements for cooperation in nuclear energy with other nations, which aided in the development of their nuclear programs. Many Middle Eastern countries are now focusing on achieving sustainability in the energy sector and reducing carbon emissions, making nuclear energy an appealing option.

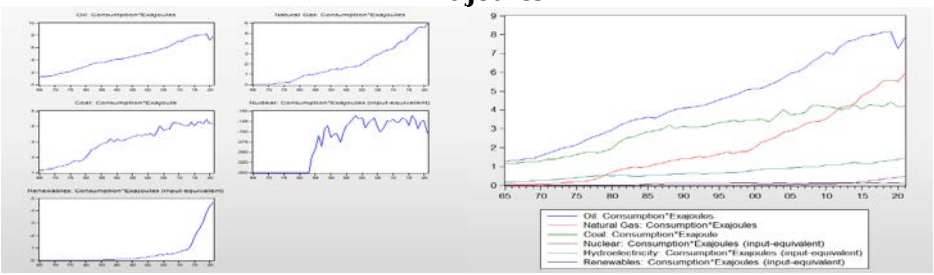
This transformation in energy consumption reflects the region's evolving priorities and efforts to diversify its energy mix and reduce dependence on fossil fuels, especially in light of environmental concerns and the need for sustainable energy sources.

3.6 Total Africa:

Regarding natural gas, its consumption curve showed a continuous increase over the studied period. While gas consumption quantities were lower than those of oil were, they displayed steady growth. This is because

natural gas pricing is not as affected by short-term disruptions as oil is in the global energy market.

Fig 6: "Trends in Energy Consumption Total Africa from 1965 to 2021 in Exajoules "



Source: "The plotted data was created by the authors via Eviews program."

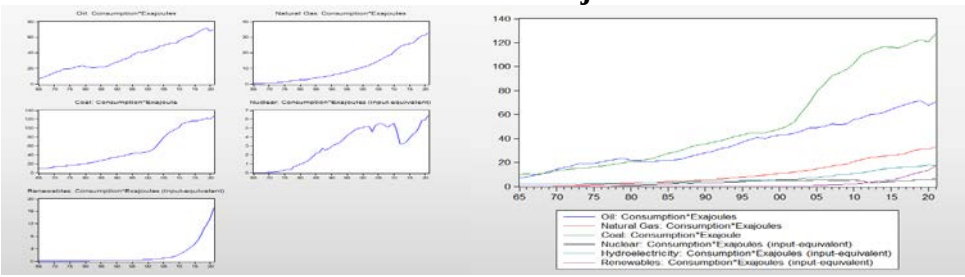
As for coal consumption in African countries, there has been continuous growth over the years due to increasing population and industrial activity. However, this growth occurred at a slower pace compared to oil consumption. Coal consumption substantially stabilized after 1988 and did not exceed 4.27 exa-joules from 2008 to 2021. This can be attributed to policies adopted by African nations to transition to renewable and cleaner energy sources, moving away from fossil fuels and environmentally harmful energy sources.

In the case of renewable energy, consumption quantities were virtually non-existent before 1971, with minimal or almost negligible amounts observed until 1985. Afterward, there was a period of stabilization in consumption from 1986 to 1996 at an approximate value of 0.01 exa-joules. Then, a gradual increase began in 1997, with consumption growing approximately every three years by 0.01 exa-joules, reaching around 0.05 exa-joules in 2008. Subsequently, there was a clear acceleration in the growth of renewable energy consumption.

In addition, nuclear energy and renewable energy experienced different developments. Nuclear energy gained momentum starting in 1984 with the establishment of the first commercial nuclear reactor in South Africa, which now contributes significantly to electricity generation. However, there are significant challenges facing the adoption of nuclear technology on the continent, including high capital costs, a shortage of qualified human capital, institutional weaknesses, and the lengthy development of strong legal and regulatory frameworks, as well as concerns about nuclear fuel proliferation. These challenges act as barriers to the widespread adoption of nuclear technology on the continent, resulting in fluctuations in nuclear energy production and consumption in the region.

3.7 Total Asia Pacific:

Fig 7: "Trends in Energy Consumption Total Asia Pacific from 1965 to 2021 in Exajoules"



Source: "The plotted data was created by the authors via Eviews program."

From the graph, it can be observed that coal was the primary source of energy in the Asia-Pacific region from the beginning of the period under study until its end.

In 1968, the consumption of coal and oil were roughly equal, after which the consumption of oil started to surpass coal, playing a significant role in meeting the region's energy needs. The consumption of both coal and oil continued to rise due to population growth, economic activity, and industrialization until around 1980 when coal and oil consumption became roughly equal again. Coal then re-emerged as the leading source, albeit with partially similar quantities, until around 2002. During this time, we witnessed a notable and accelerating increase in coal consumption compared to oil and gas, which increased at a slower and steadier pace.

In 2019, the Asia-Pacific region accounted for over 77% of the global share in total coal consumption. Furthermore, among the new coal-fired power stations commissioned in 2019, approximately two-thirds (64%) of the new capacity was in China (43.8 gigawatts), with 12% in India (8.1 gigawatts). The remaining 24% was mainly distributed across Malaysia (2.6 gigawatts), Indonesia (2.4 gigawatts), and Pakistan (2 gigawatts). Despite numerous constraints and challenges in the Asia-Pacific region that reduce coal usage, many countries continue to build coal-based power stations, led by China, India, and Indonesia, further boosting the coal market in the region.

In 2020, there was a slight decrease in coal and oil consumption due to the economic repercussions of the COVID-19 pandemic, resulting in reduced industrial activity and energy demand. The consumption of nuclear energy in the Asia-Pacific region over the decades reveals significant developments in this field. In the period between 1965 and 1968, nuclear energy usage was extremely limited, with consumption ranging between 0.01 and 0.02 exa-

joules. This minimal usage was primarily due to technological limitations and capabilities during that period.

However, in 1969, the Tarapur reactor in India, one of the early commercial reactors in the region, became operational. This event marked a turning point, with nuclear energy consumption significantly increasing and approaching 1 exa-joule. Interest in nuclear energy grew, and other countries, such as Pakistan, began constructing nuclear reactors.

In the period between 1980 and 1990, there was further expansion in nuclear energy usage, with consumption ranging between 1.06 and 3.56 exa-joules. This period witnessed an increased reliance on nuclear energy in some countries.

Since 1991, consumption has continued to rise steadily, approaching 6.46 exa-joules in 2021. This growth can be attributed to an increased awareness of the advantages of nuclear energy as a clean and sustainable alternative, along with technological advancements and an increased demand for electricity. Despite a temporary decline in consumption, in 2011 due to the Fukushima incident in Japan, which affected energy policies in many countries.

In the period from 1965 to the end of the 1970s, renewable energy consumption was extremely low, ranging between 0.01 and 0.03 exa-joules. This period may be associated with a lack of technology and awareness of the benefits of renewable energy at that time.

From the early 1980s to the mid-1990s, interest in renewable energy began to grow, and we witnessed a gradual increase in its consumption. During this period, consumption ranged from 0.18 to 0.47 exa-joules. This increase was a result of heightened awareness of environmental issues and a recognition of the environmental impact of preserving renewable energy sources.

From the mid-1990s to the beginning of the new millennium, we saw sustainable growth in the use of renewable energy, with consumption ranging from 0.52 to 2.17 exa-joules. This growth was due to technological advancements and government policies encouraging the adoption of renewable energy sources.

In the last decade, from 2010 to 2021, there was a significant increase in renewable energy consumption, ranging from 10.46 to 17.22 exa-joules. This growth reflects greater efforts in the region to promote the adoption of renewable energy as part of clean and sustainable energy strategies. It is worth mentioning that in 2012, a balance was observed between nuclear and

renewable energy consumption, after which renewable energy consumption surpassed nuclear energy consumption. This shift reflects the increasing importance placed on environmentally friendly and sustainable energy sources in the region.

4 CONCLUSION

The data clearly shows a continuous increase in the consumption of various types of energy worldwide. This increase in consumption can be attributed to several interconnected factors. First, the global population growth and urban expansion are the major driver of the rising energy demand to meet daily needs and increasing industrial requirements. The growth in population significantly escalates energy needs.

Additionally, economic growth and advances in technology, industry, and the global economy have led to increased reliance on energy sources to power machinery and drive industrial progress. These technological advancements enable companies and investors to more efficiently harness available energy resources.

Furthermore, economic and political events play a significant role in shaping energy consumption and demand patterns. as they can impact prices and government policies, thus influencing decisions and trends within the energy sector. Even health-related events have a clear impact on changing energy consumption patterns, such as the reduced air travel and increased remote work during the COVID-19 pandemic, which altered energy consumption behaviour.

Moreover, there is a growing trend towards using renewable energy sources. Many countries and communities have gradually adopted renewable energy sources since the early 20th century. These sources, including solar, wind, hydroelectric, and thermal energy, offer environmental and economic advantages, making them a sustainable alternative to fossil fuels. Solar, wind, hydro, and thermal energy have all experienced significant global growth and utilization.

However, despite these positive developments, energy supply and usage-related issues remain a global challenge. The nature and scale of these problems vary from one country to another, depending on their economy and available energy sources. In many developing countries, a significant portion of the population suffers from a severe lack of electricity supply, hindering economic development and exacerbating social challenges. Additionally, many of these countries heavily rely on oil imports to meet their energy

needs, making them susceptible to fluctuations in oil prices and vulnerable to external debt.

At the same time, advanced countries face different challenges. These challenges include reducing dependence on fossil fuels, increasing the use of renewable energy to mitigate carbon emissions and combat climate change, as well as improving energy efficiency and developing sustainable energy system technologies.

To build upon the findings of this study and align with the directions derived from it, the subsequent recommendations have been put forward.

– It is crucial to formulate tailored strategies addressing the unique challenges and opportunities presented in each region. Understanding the local economic, political, and social dynamics will help design effective policies to manage the surge in global energy demand.

– To promote sustainable practices and mitigate the challenges associated with fossil fuel dependency, countries should prioritize investments in renewable energy infrastructure. Governments, alongside international organizations, can facilitate funding and incentives for the development and adoption of renewable energy sources like solar, wind, hydroelectric, and thermal energy.

– Facilitate technology transfer programs to empower developing nations with the knowledge and tools required for the efficient use of renewable energy sources. Collaboration between developed and developing countries can accelerate the adoption of sustainable energy practices and bridge the technology gap.

– Support capacity-building initiatives in developing countries, focusing on enhancing energy production, distribution, and management capabilities. This can help address electricity shortages and bolster economic development, ultimately contributing to social progress.

– Encourage a diversified energy portfolio to reduce vulnerability to external shocks, such as fluctuations in oil prices. This involves exploring a mix of energy sources, including renewables and potentially nuclear energy, to ensure a stable and resilient energy supply.

– Foster international collaboration for policy coordination in transitioning towards sustainable energy practices. This involves aligning policies, regulations, and incentives across countries to create a conducive global environment for sustainable energy development.

– Promotion of Energy Efficiency: Emphasize the importance of energy efficiency through awareness campaigns and incentive programs.

Encouraging industries, businesses, and households to adopt energy-efficient technologies and practices can contribute significantly to reducing overall energy demand.

5 Bibliography List :

1) Amin, S. B., & Rahman, S. (2019). Urbanisation and Energy Linkages in Bangladesh (pp. p85). Retrieved from https://link.springer.com/chapter/10.1007/978-3-030-02919-7_17 doi:10.1007/978-3-030-02919-7_17

2) Anis Omri, & Kahouli, B. (2014). Causal relationships between energy consumption, foreign direct investment and economic growth: Fresh evidence from dynamic simultaneous-equations models. *ELSIEVIER*, p1. Retrieved from http://dx.doi.org/10.1016/j.enpol.2013.11.067 doi:10.1016/j.enpol.2013.11.067i

3) Arbex, M., & Perobelli, F. S. (2010). Solow meets Leontief: Economic growth and energy consumption. *Energy Economics, 32*(1), p 43, 44, 46. Retrieved from https://www.sciencedirect.com/science/article/pii/S0140988309000760 doi:10.1016/j.eneco.2009.05.004

4) Balli, F., Nee, A. Y. H., & Qalati, S. A. (2022). Proceedings of the 2022 International Conference on Economics, Smart Finance and Contemporary Trade (ESFCT 2022) (pp. 298). Retrieved from https://books.google.dz/books?id=WfujEAAAQBAJ

5) Batliwala, S., & Reddy, A. K. (1994). Energy consumption and population. *Population: the complex reality*, p1. Retrieved from https://www.researchgate.net/publication/28577526

6) Belmahi, A., & Gueddal, Z. (2023). The Solar energy as a step to restructure the electrical energy sector in Alegria - An Analytical vision-(2010-2022)."in Arabic". *Revue Les Cahires du POIDEX, Volume 12, Numéro 1*, p 341. Retrieved from https://www.asjp.cerist.dz/en/article/228330

7) BP. (2022). BP, 2022 Statistical Review of World Energy.

8) Buchanan, E. (2021). Russian Energy Strategy in the Asia-Pacific: Implications for Australia (pp. 83). Retrieved from https://books.google.dz/books?id=bdIwEAAAQBAJ

9) CarbonBrief. (2022). What does Russia's invasion of Ukraine mean for energy and climate change? Retrieved from https://www.carbonbrief.org/

10) Chiou-Wei, S. Z., Chen, C.-F., & Zhu, Z. (2008). Economic growth and energy consumption revisited — Evidence from linear and nonlinear Granger causality. *Energy Economics, 30*(6), p3070. Retrieved from https://www.sciencedirect.com/science/article/pii/S0140988308000406 doi:10.1016/j.eneco.2008.02.002

11) Dramani, J. B., & Tewari, D. (2014). An econometric analysis of residential electricity demand in Ghana. *Mediterranean Journal of Social Sciences, 5*(16), p209. Retrieved from https://www.researchgate.net/publication/269913983_An_Econometric_Analysis_of_Residential_Electricity_Demand_in_Ghana doi:10.5901/mjss.2014.v5n16p209

12) Foster, R., Ghassemi, M., & Cota, A. (2009). Solar Energy: Renewable Energy and the Environment (pp. 1). Retrieved from https://books.google.dz/books?id=DiNr-G4eawIC

13) Garcia, S., Parejo, A., Personal, E., Ignacio Guerrero, J., Biscarri, F., & Leon, C. (2021). A retrospective analysis of the impact of the COVID-19 restrictions on energy

consumption at a disaggregated level. *Appl Energy, 287*, p11. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/33536699 doi:10.1016/j.apenergy.2021.116547

14) Harris, J. M., & Roach, B. (2018). Environmental and Natural Resource Economics: A Contemporary Approach (pp. 542). Retrieved from https://books.google.dz/books?id=hgcqDwAAQBAJ&newbks=1&printsec=frontcover&hl=fr&source=gbs_ge_summary_r&cad=0

15) Hite, K. A., & Seitz, J. L. (2021). *Global Issues: An Introduction*: Wiley.

16) IMF. (2020), from https://www.imf.org/en/Home

17) Islam, F., Shahbaz, M., Ahmed, A. U., & Alam, M. M. (2013). Financial development and energy consumption nexus in Malaysia: A multivariate time series analysis. *Economic Modelling, 30*, 435-441. Retrieved from https://www.sciencedirect.com/science/article/pii/S0264999312003082 doi:10.1016/j.econmod.2012.09.033

18) Jiang, Y., Shvets, Y., & Mallick, H. (2023). Proceedings of the 2022 2nd International Conference on Economic Development and Business Culture (ICEDBC 2022) (pp. 248). Retrieved from https://books.google.dz/books?id=YrykEAAAQBAJ

19) jones. (1991). How urbanization affects energyuse in developing countries p621. Retrieved from https://www.sciencedirect.com/science/article/pii/0301421591900945

20) Khan, I., Hou, F., Irfan, M., Zakari, A., & Le, H. P. (2021). Does energy trilemma a driver of economic growth? The roles of energy use, population growth, and financial development. *Renewable and Sustainable Energy Reviews, 146*, p1. Retrieved from https://www.sciencedirect.com/science/article/pii/S1364032121004469 doi:10.1016/j.rser.2021.111157

21) Komal, R., & Abbas, F. (2015). Linking financial development, economic growth and energy consumption in Pakistan. *Renewable and Sustainable Energy Reviews, 44*, p216. Retrieved from https://www.sciencedirect.com/science/article/pii/S1364032114010673 doi:10.1016/j.rser.2014.12.015

22) Krey, V., O'Neill, B. C., van Ruijven, B., Chaturvedi, V., Daioglou, V., Eom, J., . . . Ren, X. (2012). Urban and rural energy use and carbon dioxide emissions in Asia. *Energy Economics, 34*, S272-S283. Retrieved from https://www.sciencedirect.com/science/article/pii/S0140988312000904 doi:10.1016/j.eneco.2012.04.013

23) Kurtzman, C. P., Fell, J. W., & Boekhout, T. (2010). The Yeasts: A Taxonomic Study (pp. 31). Retrieved from https://books.google.dz/books?id=wwtqAQAACAAJ

24) Madlener, R., & Sunak, Y. (2011). Impacts of urbanization on urban structures and energy demand: What can we learn for urban energy planning and urbanization management? *Sustainable Cities and Society, 1*(1), 45-53. Retrieved from https://www.sciencedirect.com/science/article/pii/S2210670710000077 doi:10.1016/j.scs.2010.08.006

25) Mankoff, J. (2011). Russian Foreign Policy: The Return of Great Power Politics (pp. 165). Retrieved from https://books.google.dz/books?id=5J0kFRei8lMC

26) Menegaki, A. N., & Ozturk, I. (2013). Growth and energy nexus in Europe revisited: Evidence from a fixed effects political economy model. *Energy Policy, 61*, 881-887. Retrieved from https://www.sciencedirect.com/science/article/pii/S0301421513005831 doi:10.1016/j.enpol.2013.06.076

27) OECD. (2020), from https://www.oecd.org/
28) Özcan, B., & Ozturk, I. (2019). Environmental Kuznets curve (EKC): a manual (pp. 43). Retrieved from https://books.google.dz/books?id=UrWXDwAAQBAJ
29) parikh, & shukla. (1995). Urbanization, energy use and greenhouse effects in economic development p87-103. Retrieved from https://www.sciencedirect.com/science/article/pii/095937809500015G
30) Rehman, A., & Deyuan, Z. (2018). Investigating the Linkage between Economic Growth, Electricity Access, Energy Use, and Population Growth in Pakistan. *Applied Sciences, 8*(12, 2442), p2. Retrieved from https://www.mdpi.com/2076-3417/8/12/2442 doi:10.3390/app8122442
31) Roach, S. (2022). Accidental Conflict: America, China, and the Clash of False Narratives (pp. 119). Retrieved from https://books.google.dz/books?id=gMOHEAAAQBAJ
32) Sadorsky, P. (2013). Do urbanization and industrialization affect energy intensity in developing countries? *Energy Economics, 37*, p52-59. Retrieved from https://www.sciencedirect.com/science/article/pii/S014098831300011X doi:10.1016/j.eneco.2013.01.009
33) Salman Haider, M. H. A., Aadil Ahmad Ganaie. (2019). Does industrialisation and urbanisation affect energy consumption. p2, 4, 8. Retrieved from http://www.accessecon.com/Pubs/EB/2019/Volume39/EB-19-V39-I1-P18.pdf
34) Shahbaz, M., & Lean, H. H. (2012). Does financial development increase energy consumption? The role of industrialization and urbanization in Tunisia. *Energy Policy, 40*, 473-479. Retrieved from https://www.sciencedirect.com/science/article/pii/S0301421511008652 doi:10.1016/j.enpol.2011.10.050
35) Susanne.A, & Wengle. (2022). Russian Politics Today (pp. 248). Retrieved from https://books.google.dz/books?id=mKKIEAAAQBAJ
36) United Nations. (2020). World Economic Situation and Prospects 2020 (pp. 64). Retrieved from https://books.google.dz/books?id=bRfWDwAAQBAJ
37) Wang, Q., & Zhang, F. (2021). What does the China's economic recovery after COVID-19 pandemic mean for the economic growth and energy consumption of other countries? *J Clean Prod, 295*, p2. Retrieved from http://www.ncbi.nlm.nih.gov/pubmed/33589853 doi:10.1016/j.jclepro.2021.126265
38) WHO. (2020), from https://www.who.int/
39) Zaheer Khan Kakar, D. B. A. K., and Muhammad Jawad Khan. (2011). Financial Development and Energy Consumption: Empirical Evidence from Pakistan. *International Journal of Trade, Economics and Finance, Vol. 2*. Retrieved from http://www.ijtef.org/papers/150-F537.pdf